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ABSTRACT

This report presents a second program review of Mathematics and Statistics in the State University System of Florida (SUS) that was conducted in 1989-90. The report reveals that all nine SUS institutions offer degree programs in Mathematics; five SUS institutions offer 10 degree programs in Statistics. It is noted that improvement has occurred since the last program review five years ago; however, the following areas are still of concern: (1) faculty salaries are low and uncompetitive compared to national levels; (2) stipends for graduate assistants are low compared to national levels; and (3) the State University should not mandate class size in mathematics courses. Six issues surrounding these disciplines are presented for consideration by the universities. First, morale among graduate students could be improved by focusing on their role as apprentice mathematicians and statisticians. Second, administrators need to recognize the need for interaction between colleagues in these disciplines and supply the necessary resources and facilities. Third, colleges should use fewer adjuncts in teaching mathematics. Fourth, serious reassessment of state statistical programs is necessary. Fifth, administrators need to be aware of the need for new statistics programs in the SUS Master Plan. And sixth, statistics should be taught by statisticians. Four appendices identify consultants and coordinators and give salary information. (GLR)

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MATHEMATICS AND STATISTICS PROGRAM REVIEW

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REVIEW OF MATHEMATICS AND STATISTICS:
STATE UNIVERSITY SYSTEM OF FLORIDA

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EXECUTIVE SUMMARY

In 1989-90, the disciplines of mathematics and statistics were reviewed for the second time in the State University System (SUS), the first review having occurred in 1984. Dr. Peter Hilton, Distinguished Professor of Mathematics at SUNY, Binghamton, served as the Lead Consultant in Mathematics, and Dr. Richard L. Anderson, Vice President of Statistical Consultants, Inc., served as Lead Consultant in Statistics for the 1989-90 program review. All nine SUS institutions offer degree programs in Mathematics, including 10 bachelor's degree programs (one of them being in applied mathematics), eight master's degree programs (three of which are in applied mathematics), and four doctoral degree programs, for a total of 22 degree programs. Five SUS institutions offer a total of 10 degree programs in Statistics, consisting of five bachelor's programs, three master's programs, and two doctoral programs. One university offers a statistics track within the mathematics degree program, and the remaining three universities do not have formal statistics programs but do offer service courses in statistics.

Both Mathematics and Statistics serve significant functions in research across many disciplines. Therefore, strength in the disciplines of mathematics and statistics is important for

two of the basic roles identified for the SUS in the 1988-89 to 1992-93 Master Plan, i.e., enhancing economic development and industrial growth, particularly in the high technology arena; and in resolving State problems through graduate instruction, research, and public service.

In most cases, significant improvement has occurred since the last program review of Mathematics and Statistics five years ago. Many of the changes are consistent with the recommendations of the previous review. However, certain problems remain on a systemwide level, as outlined below.

FOR CONSIDERATION BY THE BOARD OF REGENTS

1. Faculty salaries are low compared to national levels. This is an obstacle to effective recruitment and the retention of the best faculty. A related problem is that of salary compression brought about by the need to make competitive salary offers to new assistant professors because of market demands, resulting in their salaries being higher than those of many existing faculty in the department.
2. Stipends for graduate assistants are low compared to national levels.
3. It was unwise of the State Legislature to mandate class size in mathematics courses. Such decisions are best made by the universities and are dependent upon the nature of the

particular content of each course, the capabilities of the students, and the efficiency and effectiveness of mixing large lectures with small discussion sections.

FOR CONSIDERATION BY THE UNIVERSITIES

1. Morale among graduate students is low, due mainly to their perception that they are recruited primarily for the purpose of teaching low level courses. Morale could be improved by focusing on their role as apprentice mathematicians and statisticians.
2. The importance of facilities and resources for mathematicians and statisticians to interact with colleagues in their discipline needs to be recognized by administrators.
3. Many universities in the SUS overuse adjuncts in teaching mathematics. Adjuncts typically do not participate fully in the academic activities of the faculty and a high proportion of adjuncts is bound to have an adverse effect on a program.
4. There is a need for serious assessment of statistical programs in the SUS. Three densely populated areas (Tampa-St. Petersburg, Miami, and Orlando) need strong programs in statistics. The undergraduate and graduate programs in these areas are small or non-existent. Statistics is an integral part of high-technology industry and therefore should serve the areas with these industries with strong programs.

5. The absence of new statistics programs in the SUS Master Plan indicates a lack of awareness among the administration that a strong statistics program is an essential ingredient in research programs involving collection and analysis of data.
6. Statistics should be taught by statisticians, rather than through a variety of other disciplines.

FOREWORD

The 1989-90 program review of Mathematics and Statistics, which is reported in this document, is the second review of the two disciplines in the State University System of Florida (SUS), the first review occurred in 1984. The 1989-90 review of the Mathematics and Statistics programs in the SUS was conducted by two lead consultants (one in Mathematics and the other in Statistics) and 15 institutional consultants (nine in Mathematics and six in Statistics). A list of the institutional consultants appears in Appendix B. The entire review team attended an orientation workshop in Tallahassee on January 22, 1990, at which they were briefed on the review process by Board of Regents (BOR) staff. Following the workshop the institutional consultants dispersed to conduct one day preliminary site visits at their respective programs of review. The lead consultants travelled to each of the universities, accompanied by Dr. William Caldwell (the BOR coordinator and faculty consultant for the review). At each university, the team of lead consultants and Dr. Caldwell joined the institutional consultants in conducting a one day team review of the Mathematics and Statistics programs at that university. The site visits were concluded on February 15, 1990.

The final SUS program review document was composed by the lead consultants, based on the reports prepared by the institutional consultants. The draft report was reviewed by BOR staff and the universities, following which a debriefing was held on October 26, 1990, via a conference call. The debriefing included the lead consultants, the chairs, university coordinators, central administrator representatives from each university, and BOR staff.

PART I MATHEMATICS

Mathematics: The State of the Art

By way of preamble to this report, we include here a statement about the characteristic features of mathematics today, insofar as they influence our views about how best to foster mathematical activity in our universities.

1. Mathematical Research. It remains the case, as it was at the time of the last review, that mathematical research is enormously active in the universities of this country, as in those of all highly-developed industrial societies. However, a trend which was beginning to become apparent in the early 1980's has now established itself; namely, whereas hitherto progress consisted predominantly of the development of autonomous subdisciplines of mathematics, today we are seeing a considerable amount of exciting progress in building links between the various branches; we may say that the lattice of mathematical knowledge is being enriched, now, by horizontal as much as by vertical progress. By the same token we are seeing some very strong interaction between mathematics and the various sciences, notably physics, economics, computer science, biology, and various branches of engineering. As a very healthy consequence of these developments, the distinction between pure and applied mathematics is becoming increasingly blurred. There are today practically no branches of mathematics which are not, in principle, applicable, however "pure" the motivations of the mathematicians who pioneered them.

2. Availiabilty of, and technical advances in, the computer. The computer is now an integral part of the world of the student. Moreover, technical advances have tended to downgrade the importance of mere programming skill and to emphasize the importance of the exploration of the versatile potential of the computer in both teaching and research in mathematics. How we teach and what we teach are both in the process of being profoundly affected. Moreover, certain parts of mathematics (e.g., the theory of algorithms) are coming into prominence - or even actually into existence - as a result of the ubiquitous computer, while its remarkable capacities, including the ability to execute symbolic manipulations, are leading to new directions in mathematics and also to the decline in importance of certain traditional areas of the curriculum.

3. The widening role of mathematics. As we have said, certain areas of mathematics (for example, number theory, finite field theory), hitherto regarded as ineffably pure, are proving highly applicable to the concerns of modern society (for example, information theory, coding theory). It is also true that certain areas of human enquiry, previously immune to mathematical assault, are now advancing through the application of sophisticated mathematical techniques. These developments imply that the ability to do mathematics, to think mathematically, should be inculcated in all those wishing to contribute to progress or even to appreciate the benefits of progress; we would assert categorically that no student should

go through an undergraduate program without acquiring some familiarity with quantitative thinking and mathematical reasoning. The implications for the role of the mathematics departments in our universities are clear, and thought - provoking.

Mathematics in the State University System:

Overall Remarks

The general impression created by the nine campuses visited was very favorable. In most cases distinct improvements over the past five years were clearly in evidence; moreover, these improvements were frequently in directions indicated as both desirable and feasible in the previous report to the Board of Regents (BOR). Thus, not only is it pleasing to be able to report a general improvement in performance levels in teaching and research; it is also satisfactory to be able to report a vindication of the evaluation procedure adopted by the BOR.

This said, it is necessary to draw attention to certain persistent problems which have a systemwide character. The order in which these will be addressed is not intended to convey any view as to their relative importance; indeed, they are of so different a nature, one from another, that it is not really meaningful to assign them an order of importance.

First, we mention the issue of low salaries in relation to national levels. This is both intrinsically unsatisfactory and also an obvious handicap to effective recruitment of new faculty and retention of the best faculty. Moreover, it is likely to be accompanied - as is the case on many of the campuses of SUS - by a policy of confining recruiting to the junior ranks. Such a policy makes it difficult, if not impossible, to make the sort of qualitative leap which many

administrations claim they are encouraging their mathematics departments to achieve.

Second, we frequently found low morale among the graduate students. It is, of course, perfectly legitimate to use graduate students extensively as teaching assistants involved in the main in low-level courses. However, it cannot be right to allow a situation in which the graduate students perceive the execution of these duties as the reason for their being recruited. Where this impression had taken root among the graduate students it was often greatly strengthened by their being subjected to very unfavorable working conditions, distributed in a number of different buildings far removed from the mathematics building. It is essential that graduate students be made, and feel themselves to be, part of the mathematical community, with easy access to the members of the mathematics faculty. It is also essential that the university administration be seen to regard them primarily as apprentice mathematicians - and only secondarily as useful auxiliaries in the university's own teaching mission.

Third, we are distressed at the overuse of adjuncts which we found on many campuses of the system. We understand the pressure of financial exigency. But we must state that such a practice is bound to have an adverse effect on the quality of the academic enterprise. Adjuncts never play a full part in the life of the department; typically they arrive on campus to give their courses and then depart. Thus they are not at all

involved in other professional activities of the faculty; moreover, they also tend to play no role in the thinking that goes into course improvement, and they are not available to students who wish to consult their teachers. We also found cases where adjuncts performed teaching duties for which regular faculty were available - that, of course, adds an extra dimension to the problem.

Fourth, we found a general unawareness among administrations of the importance for mathematicians of facilities for contact with other mathematicians (this is a universal complaint among mathematicians in this country). To a research mathematician, his, or her, most important item of equipment is access to a mathematician working in a related area. To a scholar and teacher, access to those who can convey the latest ideas in mathematics and the teaching of it is vital. Thus it is of critical importance that a good department have an active colloquium program, that its members be supported to travel to professional meetings, and that there be funds to invite both short-term and long-term visitors to the campus. We recognize that Florida's geographical location makes the provision of these essentials expensive; the irony is that the same factor makes their provision all the more urgent.

Fifth, we must mention, briefly, the class size problem. We believe it was unwise of the legislature to try to solve this problem by mandate. Mandated class-size limitations tend to be of a crude nature, failing to take account of the fact that

acceptable class-size is a function of the level of sophistication of the student and of the material; and that it also depends on the level of availability of instructional support services.

UNIVERSITY OF FLORIDA

General Remarks

The Department of Mathematics is functioning very well. It is a strong, cohesive department, performing its duties conscientiously, and effectively, both in teaching and in research. The chairman is successful, enjoying the support of his colleagues and fully alive to the various aspects of his responsibilities. He enjoys very good relations with the Dean, which bodes well for the future of the department. Other members of the senior administration of the university appear to have been less convinced of the fine performance of the department and the harmony of its members, and we hope that our visit has gone some way towards dispelling their doubts.

The Growth of the Department

The department has advanced conspicuously in quality since the 1984 Board of Regents report. Several very good appointments have been made, both at the assistant professor and more senior levels. Indeed, any one of the present batch of seven assistant professors has the potential to grow into an outstanding mathematician. A new full professor was recently awarded the highly prestigious Junior Berwick Prize of the London Mathematical Society. It is also noteworthy that 45 percent of the faculty received funding from federal sources for summer research in 1989 - a very creditable figure.

On the other hand, there has not been anything like the increase in quantity recommended in the 1984 report. The increase in the size of the faculty, from 42 to 46, falls very much short of the figure recommended. (The administration contests the figures given to us by the department; the discrepancy seems to be due to a curious distinction between official lines and positions the department is actually authorized to fill.) The result is a heavy teaching load by comparison with other mathematics departments of comparable research standard - a problem aggravated by the State-mandated class size limitation (but temporarily relieved, perhaps, by the reduced freshman intake).

However, the slow faculty growth rate is also itself a cause for concern from the point of view of the maintenance of quality - let alone the maintenance of the rate of improvement. New faculty were attracted in anticipation of a substantial growth rate - if this is not maintained, many may seek positions elsewhere. Thus it is essential that there be a clearly perceived, long-range plan for the further development of the department, but that this plan be sufficiently flexible to allow the university to take advantage of special opportunities for acquiring distinguished faculty.

It is also necessary that flexibility be shown with respect to the issue of offering tenure to incoming faculty. There is evidence that certain potential new recruits have been lost because they could not be appointed with tenure, and that

certain other new arrivals were not retained for the same reason. Certainly this bureaucratic regulation places the department at a noticeable disadvantage vis-a-vis comparable mathematics departments elsewhere. This is particularly regrettable since the department clearly now has the potential to advance further in quality and enter the ranks of the top 10 or 15 in the country; however, to achieve progress of this kind, it will, in our judgment, be essential to follow the recommendations of the lead and local consultants. Failure to do so could well result in a marked fall in quality.

The Size-of-Class Issue

The department has conscientiously endeavored to meet the guidelines with respect to this State-mandated regulation, and has achieved the required ratio in most of its basic courses. However, the problem is, of course, very closely related to that of the size of the department; it would, moreover, clearly be helpful if the department could further increase the number of its graduate students, and hence of the TA's available for teaching the elementary courses.

The two conspicuously unsatisfactory courses are (i) the first semester of engineering calculus and (ii) the first semester of business calculus. With respect to (i) the lecture classes are too large for effective teaching, but the recitation sections are well-handled. With respect to (ii), it is

very unfortunate that the lecture classes are not complemented by any recitation sections.

Undergraduate Teaching

First, we must state categorically that we found no evidence whatsoever of a lack of interest in undergraduate teaching on the part of the faculty, though, of course, a very small number of professors may exhibit an inadequate conscientiousness in this regard. In particular, we were assured, by those whose dedication to undergraduate teaching is beyond dispute, that the members of the faculty active in research showed much enthusiasm for teaching the Honors Calculus courses. It is necessary to assert this strongly in view of the misconception, that seems to be present in the minds of certain members of the senior administration, that there exists in the mathematics department an antithesis between teaching and research. Not surprisingly, the contrary is very close to the exact truth.

We were much impressed by the improved quality of the undergraduate mathematics major (though we could wish there were more students), by the accessibility of the faculty on an informal basis, and by the variety of options open to the major, reflecting the principal areas of current activity in mathematics and the mathematical sciences. On the other hand, we were struck by the absence of any formal mechanism for student advising. Thus the students we met - an extremely articulate and intelligent group - did not know about the

possibility of graduating with honors in mathematics, nor about the possibility of pursuing independent study with a faculty member. Further, the department did not appear to follow up the careers of its graduating majors.

The Graduate Program

There are now many Ph.D.'s "in the pipeline," but the production of Ph.D.'s, given the quality of the faculty, has been disappointing and would have been much worse, but for the acquisition of foreign graduate students of substantial talent and mathematical background. However, these problems reflect a national malaise and are by no means confined to UF.

We were astonished at the burden of written examinations laid on the students prior to admission to candidacy. We were told that this was necessary, in part, because the first year examinations also served the needs of the candidates for a Master's degree, but we did not find this argument compelling. We urge the department to consider reducing the burden of written examinations, and to consider the possible role of a short, expository thesis - or an oral presentation - as an alternative assessment instrument. We emphasize the importance, for an apprentice mathematician, of becoming familiar with the discipline of mathematical research as early as possible.

In our conversations with graduate students - disappointingly few showed up, but those who did impressed us

with their acumen and maturity - we were made aware of their difficulties. Principal, of course, are their appalling working conditions, several to an office in scattered buildings far removed from Walker Hall. We believe the department should do more to try to integrate them into the life of the department, especially so long as these conditions persist; specifically, we recommend the inauguration of regular departmental teas, which would furnish them with the opportunity to get to know each other and the faculty on an informal basis.

There were complaints of the lack of advanced courses, which the students perceived as being due to the rule which only allows faculty credit for a course if at least seven students are registered. It was our belief that faculty-size was probably a more cogent explanation, as the administration appeared to be quite liberal in granting exceptions to the numerical rule.

A further source of difficulty for the students was the late publication of the budget; as a result, the students did not know till early summer whether they would be supported that summer. With alternative summer job opportunities in Gainesville being almost non-existent, it is easy to see that this is a real problem.

Conclusion

Much that is very positive has been done by the department since the 1984 report. However, the department is still rather

far from achieving the goal of "entering the top 10", nor has it moved appreciably closer to the target of a faculty-size of 65 recommended in that report.

Moreover, and most importantly, the undoubted gains made have not achieved a stable state. More must be done in order to consolidate the improvement. The administration must make plain to the department that they recognize its importance both as a center of excellence and as a performer of crucial services to the entire university, and that they will support it to the fullest extent possible to grow further in size and quality.

The lead consultant endorses strongly all the recommendations of the local consultant, and entirely approves the basis on which these recommendations were made.

FLORIDA STATE UNIVERSITY

General Remarks

The Department of Mathematics has improved in size and quality since the 1984 BOR report. Indeed, the quality of the faculty of the department made a very positive impression on us. It possesses several distinguished researchers, working in exciting areas of pure and applied mathematics, and several outstanding teachers (many also fine researchers, of course). If we could assume a continuation of the upward curve, then it would be perfectly reasonable to project a very high national ranking for the department by 1995. However, there are considerable grounds for apprehension for the immediate future. The senior administration sees the university's strict adherence to the letter and spirit of state-mandated regulations with respect to class size and the provision of elementary courses in accordance with the Gordon Rules as the principal source of the difficulties which the department is experiencing; but this is not at all the perception of the department. Indeed, a result of the university's very principled adherence to the Gordon Rule is that the department has been able substantially to increase the number of TA's it can employ and thus to strengthen its graduate program. Thus while the teaching load of these TA's is a heavy one as a result of the large number of students requiring very elementary precalculus courses, there has been, at the same

time, a very positive effect on one of the principal activities of the department as a potential center of excellence - its graduate program. Nevertheless, the grounds for concern are very solid and will be a key feature of this report.

Quality of Faculty

The department has made substantial gains since the 1984 report. There have been six (6) new appointments in pure mathematics and three (3) in applied mathematics (fluid dynamics and numerical analysis). There are effectively four (4) principal areas of interest among the faculty: applied mathematics; topology; algebra; and analysis. The first two are strong by any standards; the algebra group is very close knit and effective in the areas of commutative ring theory and Hopf algebra; only the analysis group is in conspicuous need of strengthening. Relations between pure and applied mathematicians are on the whole good, despite the fact that the applied mathematicians are heavily outnumbered and, in general, better able to secure financial support. Inevitably, they have access to funds, directly and indirectly, denied to pure mathematics; in this connection, the presence of SCRI is obviously a contributory factor.

The department has been chaired over the period under review by mathematicians who have commanded the support and respect of their colleagues; and there is every reason to suppose that this situation will persist when the newly-appointed chairman

assumes office. Nevertheless, it must be recorded that a good case could have been made - and was made by several members of the department - for seeking a chairman from the outside. This is because any new chairman is going to have to engage in difficult negotiations with the administration to ensure the survival, let alone the improvement, of a quality department; and it is always the case that a newly - arrived senior person, with a strong research record, has an advantage in this respect over any colleague selected from within.

It is by no means only in this respect that hiring policy militates against the further development of the department. If only new Ph.D.'s are hired, then it is only possible to build on one's areas of strength. For no new Ph.D. should, in his/her best interests, join a department where those interests are unrepresented or only weakly or peripherally represented. Moreover, should such a young mathematician be recruited, one would expect him/her to be lured away to another institution if he/she developed as one hoped. Further, even within a given mathematical discipline, the exclusive hiring of very inexperienced people tends to militate towards a certain narrowness of the group's focus of interest - though this, of course, need not happen.

The Graduate Program

The graduate program is surely in a much healthier condition than it was in 1984. There are many more students and,

although the production of Ph.D.'s is still disappointingly low for so distinguished a faculty, there are good grounds for anticipating a substantial improvement in the near future. It is impressive that many graduate students wish to work in applied mathematics. This puts some strain on the resources of the faculty to provide thesis advisers; but it is undoubtedly a healthy development.

On the other hand, the graduate students do have some legitimate grounds for complaint. They are scattered in inadequate accommodation in some five buildings, all separated from the mathematics building. Thus they lose the most valuable asset a university department can provide for graduate students - easy, informal access to their peers and to experts in their chosen field. (This problem is aggravated by the recent suspension of telephone facilities.) It is, however, striking that neither this problem, nor their heavy teaching load, constituted their main - and unanimous - complaint. This was that they perceive the university administration as regarding them as apprentice teachers, not apprentice research workers and scholars. "We are hired hands, paid to teach" was the vivid expression used. (It is interesting to remark, parenthetically, that members of the administration attributed to the legislature the view that teaching was the main function of mathematics departments and that graduate studies should be given the lowest priority). We cannot comment on the accuracy of the students' perceptions, but, since they are fulfilling an

absolutely crucial teaching role, it is understandable that this viewpoint should have arisen. It is vital that the students be convinced that their graduate studies are perceived by the administration and legislature as integral to the fulfillment by the university of its mission; and that the administration should understand that the commitment of the mathematics graduate students to scholarly work is no less than that of their more fortunate fellows in physics and chemistry.

Faculty Complaints

It is probably no exaggeration to describe the situation within the faculty as critical. There were many complaints of low faculty salaries, which were believed by some to reflect a lack of appreciation on the part of certain members of the senior administration. It was also objected that it was not possible to make realistic offers to outstanding candidates for appointment. The prediction was made that the department would lose many of its best young mathematicians unless the situation with respect to salaries, actual and offered, was substantially improved.

However, it was represented to us that the overall atmosphere of "penny-pinching" within the department was demoralizing-reduced telephone services, little money for colloquium speakers or for travel to meetings, none for visiting appointments. It was especially resented that, when a faculty member went on sabbatical leave, the half-salary

thereby saved did not revert to the department to make appropriate replacement appointments. (We understand that a certain amount - $5,300 - is made available in these circumstances to the department). The mood of many of the brightest of the younger faculty - reflected in the phrase "It's like living in the Third World" - left us in no doubt as to the seriousness of the situation.

Satisfying the Gordon Rule

While we respect the intentions of the State Legislature, we feel we should take this opportunity to assert that we do not believe their intended purpose is being served by putting thousands of students, statewide, through traditional algebra courses. It is not merely that such courses should not be part of a university curriculum; we do not believe they serve any useful purpose whatsoever, and certainly do not prepare our citizens for the uses of mathematics they will encounter in their lives. Moreover, we are aware of no evidence that class size - so long as it is under 100 - plays any role in the effectiveness of such courses, whatever purpose they are intended to serve. We urge reconsideration of this entire enterprise - upon which we would not have presumed to comment had it not featured so prominently in our discussions with the university administration.

Recommendations

While entirely supporting all the arguments and conclusions of the local consultant, the lead consultant would wish to emphasize the following recommendations already implicit or explicit in the local consultant's report.

1. Faculty salaries must be substantially improved.
2. The university administration must adopt, and must be seen to adopt, a position of respect and appreciation for the quality and endeavor of the faculty and for the scholarly commitment of the graduate students.
3. The working conditions of graduate students must be improved.
4. The graduate assistants must be located in close proximity to the faculty. The consultants strongly endorse the University's request for a new Science and Mathematics building, which will give the graduate assistants ready informal access to the faculty.
5. The atmosphere of "penny-pinching" in the department must be dispelled.
6. The University must endeavor to make some senior faculty appointments.

FLORIDA A & M UNIVERSITY

General Remarks

Administration and faculty are agreed on the conspicuous advantages of having established a Department of Mathematics, affording mathematics a visibility and an entity which it needs in order to attract students to its study. The faculty of the department exhibits a remarkable sense of dedication to the university and the good of its students, a dedication clearly appreciated by the senior administration. However, there are very serious problems, sharply aggravated by the dramatic increase in the number of students (the student body, already swollen at 7,000, will further increase to 8,000 in the coming academic year). Thus this report will largely concern itself with the problems, recognizing that only a few of them can be addressed by the administration without substantial additional resources.

However, before discussing the problems, we should record our very favorable impression of the quality of the mathematics majors and of the program offered to them by the department. The provision of four tracks for the major indicates the great variety of programs available. The newly established actuarial track is proving very popular; this is due in part to the availability of special scholarships for students on this track. We also noticed that certain enthusiastic instructors had also acted as advocates of this particular choice. It

seems possible that the "traditional" track may fall into desuetude as it is perceived as the most demanding and is not seen to lead to well-paid employment.

However, when one also takes into account the improvement in the average CLAST scores, one must conclude that the department is performing its teaching role most creditably. (Actually, the effort is even more praiseworthy; some faculty members each spend three (3) hours, five (5) evenings a week, for the ten (10) weeks proceeding the CLAST, tutoring groups of two hundred (200) students without receiving any compensation. Such service can only be called heroic.)

We now turn to a description of the problems.

The Space Problem

Perhaps the most serious problem facing the mathematics department is the absence of adequate accommodation. It is bad enough having to lecture to forty-five (45) students and to grade their homework and their tests with no assistance; but it compounds the problem when the classroom was only designed to hold thirty (30) students. Moreover, the faculty have to lecture in a number of different buildings so that the time after class, which should be devoted to dealing with students' questions, is spent instead hiking strenuously from one building to another. The mathematicians desperately need their own building, to house their offices, classrooms and other facilities. It is to be hoped that the building of the Science

Research Facility will alleviate some of the acute space problems, but it would appear utopian to expect this building to be ready for occupancy in less than five (5) years; and the General Classroom Building has not even been authorized.

The Teaching Load

This is extremely high, at thirteen (13) hours a week, even if the classes were not so large, and even if the instructors did not also have to act as papergraders. In imposing such conditions, the university is killing the geese that lay the golden eggs. It has a wonderfully dedicated faculty who are being driven to desperation by their work overload - for, of course, they perform many functions in addition to their teaching duties. It is indeed paradoxical that the administration insists on scholarly work as a criterion for promotion to tenured rank and, at the same time, makes it virtually impossible for the faculty to undertake such work. In this connection we are disturbed, too, by a recent practice of making 12-month (rather than 9-month) appointments. We feel it should be the responsibility of the chair of the department to allocate summer teaching duties, based on her/his assessment of each faculty member's, and the students', best interests.

We would like to make two explicit recommendations. First, we recommend that the university aim for a faculty staffing level which would permit the chair to allocate release time to faculty to help in faculty development and the maintenance of

scholarly and research activity. Second, we recommend that talented junior and senior mathematics majors be employed as papergraders in the lower division courses to release faculty for other duties; this might also have the good effect of increasing the number of mathematics majors.

Of course, a key to the solution to the problem is the appointment of new faculty and the enlargement of the size of the faculty. Such steps are urgently needed; and we recommend that offers of assistant professorships to applicants holding the Ph.D. should be made at a starting salary level of $32,000 for nine (9) months. We also recommend that candidates working, or willing to work, for the Ph.D. be encouraged to apply for Instructorships which would carry a lighter teaching load, thus enabling their holders to pursue their dissertation research (probably at FSU). An instructor in this position should be able to expect to be switched immediately into the tenure track at the Assistant Professor level on achieving the doctorate.

The Shortage of Support Personnel and Facilities

The secretarial assistance available to the faculty is grossly inadequate. It is a shameful waste of the special skills and knowledge of the faculty to have them doing all their own secretarial work - and it interferes with their effectiveness as teacher and scholar and with their availability to students.

There should be more Xerox machines, more telephones, in short, more support for the teaching mission of the faculty. We are convinced that such visible support would contribute powerfully to raising the morale of the faculty and to giving mathematics more prestige among the students.

Student Numbers

We perceive the problems listed as urgently requiring solution. Without any intervention they will get even worse as numbers of students increase - we understand an increase from 7,000 to 8,000 is projected for the coming academic year. It is an irony that student quality is also improving even as the university's resources are becoming strained to breaking point. We were very impressed by the quality, the articulateness and the sense of purpose of the students we met - as we were impressed by the extraordinary dedication of the faculty and the deep concern of the administration. Unfortunately, these university assets, priceless as they are, are not enough.

We strongly support the detailed recommendations of the local consultant. However, we would also stress the importance and urgency of our own recommendation as to starting salaries for assistant professors.

UNIVERSITY OF SOUTH FLORIDA

General Remarks

There has undoubtedly been a substantial strengthening of the department since the last review, with the appointment of several very promising mathematicians at the junior level. The graduate program has been very significantly enlarged, and the department is to be congratulated on its initiative in establishing an Institute for Constructive Mathematics with its own research journal; and on hosting a highly prestigious international conference, jointly sponsored by the Soviet Union, which will undoubtedly establish USF as a recognized center for research in approximation theory and its various applications.

On the other hand, it cannot be denied that there are serious problems facing the department which may militate against its playing the full role it should be playing in the teaching and research missions of the university. These problems will dominate the discussion in the remainder of this report.

University Organization

We were informed that the faculties of natural science, social science, arts, and letters are to be amalgamated into a single college; and a perfunctory, and unconvincing, effort was made to present this change as being to the advantage of the

individual departments, including mathematics, within such a heterogeneous amalgam. We do not believe that such a hypothetical advantage is either the real cause or likely effect of the establishment of this unwieldy colossus. The dean of the new college will necessarily be inexpert in more fields under its jurisdiction than is the experience of most college deans; and therefore will probably feel obliged to appoint associate deans with functional responsibilities. Thus the most palpable effect of the change on the mathematics department may well be to insert an extra bureaucratic layer into the administrative hierarchy.

Moreover, it is particularly unfortunate that the mathematics department will be separated even more firmly from the engineering school, with whom it has so many common professional interests and concerns. We develop this point below.

Service Courses

A good mathematics department, as that at USF undoubtedly is, has a vital service role to play, since mathematics enters crucially into so many disciplines, and is, in any case, an essential prerequisite for intelligent decision-making in contemporary society. It is thus extremely disquieting to find the department playing only a very minor role in upper division and graduate service teaching of mathematics, the major role being usurped by the school of engineering. We understand the

historical reasons for this anomaly, but we would have hoped that goodwill and common sense would have mandated a move to liquidate it. We declare categorically that mathematics, in both its intrinsic and its applied aspects, is moving so fast that only mathematicians can stay abreast of developments. By all means let mathematicians consult with client departments in devising the most effective syllabus and teaching strategy; but it is inexcusable to exclude mathematicians from any role in the teaching of mathematics.

Graduate Program

The graduate program is, by and large, in good shape. It has increased substantially in size; there are some very good students; and the present students speak well of the program and its implementation and of the accessibility of the faculty. There have been comprehensive curricular revisions - as also of the undergraduate program - which have strengthened the program by ensuring that graduates of the program - both masters and doctors - are well grounded in core areas of mathematics.

However, the high profile of approximation theory in the interests of the faculty is fully reflected in the specializations of the students, and this creates a certain bias. More serious still, however, is the high proportion of foreign students in the graduate program. This is, of course, a national problem; but, at USF, the recruiting strategy is bound to exacerbate the problem. The likely decline in the

availability of students from mainland China may well cause a serious consequent decline in graduate student enrollment in mathematics at USF; the plan we heard to counter this decline was to recruit in Eastern Europe.

The consultants are not happy about Teaching Assistant (TA) stipends at USF which are substantially below those at UF and FSU.

Faculty Unrest.

That there is serious, and quite widespread, unrest among the faculty of the department is obvious. There seem to be two principal, and related, causes. First, there are extraordinary disparities in the salaries of faculty members. That those members of the faculty whose work, scholarly and entrepreneurial, has brought great benefit to the university should receive high salaries is perfectly reasonable; but that the less conspicuous but worthy research efforts of others should go utterly unrecognized is demoralizing. There are fine mathematical scholars in the department, engaged on difficult and important research, publishing regularly, though not frequently, papers which represent very solid contributions, who have received essentially no merit or discretionary salary raises for some time.

A second, related cause for dissatisfaction is the preference given to a particular area of mathematics - approximation theory - in the department's hiring policy.

There is certainly much to be said for building on a department's strengths, but care must be taken not to create areas of undue weakness and not to leave current faculty members with a sense of being beleaguered and isolated survivors. This is clearly the situation with regard to statistics, for example; but the lead consultant in that discipline is far better qualified to discuss the consequences of neglect in that area. However, there are also examples of this neglect in areas of pure mathematics, with serious consequences for the morale and cohesiveness of the department.

Space Problems.

The department has grave space problems; indeed, one would be inclined to say that the department needs a new building. To make room for the enlarged faculty and graduate student population, blackboards have been ripped from walls and there is no space for a study hall-merely one inadequate table. Thus have two of the essential requisites for the successful study, creation and teaching of mathematics been severely reduced or eliminated. There is no faculty lounge - it is to be hoped that the senior administration understands that a faculty lounge is vital for the informal exchange of ideas which is the prerequisite for significant advance in mathematics and the creation of new knowledge - quite apart from its importance as a forum for the discussion of course content and curriculum.

Library

We heard cogent complaints from the faculty about difficulties in ordering new journals and the interruptions of certain existing subscriptions (including Inventiones Mathematicae, probably the most important mathematical research journal published outside the United States). It is true that many of these interrupted subscriptions have been resumed, but the effect is to create large gaps in the sequences. We recommend that the administration aim to provide the mathematics department with a new building, which should include a departmental library.

Employment of Adjuncts

We understand that some lecture class sizes are unduly large, and that the university endeavors to reduce class size by employing adjunct faculty. We were given the figure of 29 adjuncts in the mathematics department. This is certainly far too large. In any case, we hold that the employment of adjuncts is only justifiable as an interim response to an unexpected emergency and should not be part of a long-term policy. Adjuncts may be competent teachers but they do not play a full part in the academic enterprise of a university. They are employed, generally, to save money, not to raise standards. Efforts should be made to increase the number of full-time ranked faculty by at least six (6) in order to substantially diminish the dependence on adjuncts. The lead

consultant endorses strongly all the recommendations of the local consultant, and commends his very well-documented report to the earnest consideration of the Board of Regents and the senior administration at USF.

FLORIDA ATLANTIC UNIVERSITY

Overall Remarks

The general impression was very favorable. Mutual trust and respect appear to exist between faculty and administration; and students, both undergraduate and graduate, give a strong endorsement to the quality of the instruction they receive and the accessibility of the faculty and their receptivity to their problems. There have been some very good appointments and the department is fortunate to be chaired by a fine mathematician with a flair for administration and excellent judgment, who enjoys the confidence of the top administration. A particularly imaginative appointment, on a part-time basis, has recently been made of a mathematical biologist, who is acting as a catalyst for interaction, at the graduate and research level, between mathematics and science. Yet this outstanding individual is by no means a unique example of a first-class researcher, engaged in investigations of enormous current interest to the scientific community, and able and willing, through membership of the FAU faculty, to enrich the mathematics program of the institution. The future looks very bright but for the financial cloud which appears to hang overhead, and about whose effect more will be said below.

It is undoubtedly good for the morale, self-esteem and actual creative output of the faculty that a Ph.D. program has been inaugurated. However, it is far too early to make any

sort of judgment of its success, beyond remarking that the program has been sensibly conceived and is being properly and conscientiously executed. It would be appropriate, on the occasion of the next review, to scrutinize this program carefully.

A final comment before we discuss detailed issues concerns the splendid initiative of the faculty in organizing important national and international mathematical conferences on the Boca Raton campus. This brings great kudos to the university, as well as enhancing the research activity of the mathematics faculty.

Salaries

The greatest single problem facing the department in its effort to recruit new faculty of the calibre required for a first rate teaching and research mission is the low level of the salaries in relation to the national market. This problem also affects the prospects for retaining the best of the existing faculty and thus introduces a strong element of instability which can invalidate the most careful long-term planning. We strongly recommend that this problem be seriously addressed.

Undergraduate Program

We entirely endorse the views and recommendations of the local consultant with regard to the introduction of an honors

program in mathematics; to the maintenance of a high profile by the office of the Dean of Students; and to the reduction of class sizes in the business calculus courses. All these recommendations would, if implemented, serve to improve student morale and performance. We put special emphasis on Recommendation 3 of the local consultant.

Graduate Program

We first remark that it is essential that the Graduate School take over responsibility for handling graduate admissions. Such a change could be achieved quickly at no cost. Of greater significance in the long-term would be the establishment of closer relations between the Mathematics Department and local industry, to their mutual benefit. We believe the will is there, but it is a time-consuming job to actually put the necessary mechanisms in place. We believe that local industry might well give appropriate employees a year's leave on half-pay to enroll in a masters - or even a Ph.D. - program.

We would go further than the local consultant with regard to his Recommendation 4, and actually recommend that it be made possible to get the MA by examination only; let us add by way of clarification that part of the examination might well be oral.

Teaching and Research

We were aware of a certain apprehension on the part of some members of the top administration that there might be a reluctance on the part of high-powered mathematicians to teach elementary courses - and that this problem might be exacerbated as the department increased its strength in research. We can refute this viewpoint; the research-oriented members of the faculty share with their colleagues a full appreciation of the importance of this aspect of their teaching as an integral part of the university's mission. The chairman of the department, both by example and precept, has set exactly the right tone to ensure that teaching and research, far from being antithetical, are complementary activities of the faculty.

Report of the Local Consultant

In conclusion we would wish to give strong support to the report of the local consultant, whose perspective we share and whose recommendations, even where not specifically referred to in our own report, we endorse.

UNIVERSITY OF WEST FLORIDA

General Remarks

There appears to have been a deterioration in the position of the Department of Mathematics in comparison with the situation obtaining at the time of the previous review. Put simply, the department is overextended. The increase in student enrollment has not been matched by a corresponding growth in faculty size, especially when the impact of the Gordon Rule is taken into account. There are salary problems which are similar to those at other campuses of the Florida State System; but in this case they are felt most acutely by newly recruited faculty and thus militate against stability and high morale. However, reports from students, alumni and representatives of local industry indicate that the department is doing an excellent teaching job in spite of the difficulties being experienced. The departmental chairman is a man of scrupulous fairness seeking to do his best for the students and for his colleagues, and finds himself in a difficult situation. We share with him, in particular, a distaste for the overuse of adjuncts - a device whose only justification can be financial and which undoubtedly militates against excellence in teaching. Whatever the financial stringencies we can see no justification for employing adjuncts to teach courses (e.g., in the summer) for which competent faculty are available.

Despite the gravity of the problems, we have confidence that they will be solved. This optimism is based largely on our great respect for the President of UWF and the evident sincerity of his intention to help the department in every way possible.

We now go into greater detail over some of the problems referred to.

Faculty Morale

This is low, especially among the younger faculty. In the first place, they have a high teaching load and low salaries; but their tribulations are confounded by their perception that the department is viewed by the administration as basically a service department, while their own individual prospects are predominantly influenced by their research output. They are thus led to complain of unreasonable expectations by the administration. As an example, we were told that one publication by a young faculty member was virtually ignored because it was a contribution by mathematics to science and not a contribution to mathematics, and thus did not appear in a journal devoted to the publication of new mathematics. Yet it is plain that members of a small department in a relatively isolated geographical location should be encouraged to involve themselves in such interdisciplinary research.

The perceptions discussed above have led to a loss of confidence in the promotion and tenure procedures, and to

disillusionment over the prospects for development of the graduate program, which is currently plainly too small. The department has an urgent need of more TA's, both in its teaching role and to create a viable master's program. Perhaps local high-tech industry could be persuaded to cooperate in this regard.

Dependence on Adjuncts

This unhealthy dependence would also be reduced by increasing the number of TA's. Adjuncts are currently very much overused and it is extremely dangerous for a university to become dependent on the availability of adjuncts who are willing to work for the low remuneration offered.

Course Overloads

Currently it is possible for faculty members to increase their salaries by volunteering for course overloads, teaching at branch campuses. We are not at all happy with this arrangement. The department should be given additional lines to meet such teaching responsibilities. It is, moreover, very much to the long-term disadvantage of a young faculty member to burden himself (or herself) with a course overload, on top of an already heavy load. Thus we see how the existence of low salaries is not only inequitable in itself, but leads to consequences gravely disadvantageous to the whole academic enterprise.

Career Advice

We heard from a number of students, who were otherwise very complimentary about the teaching they had received and the general helpfulness of the departmental faculty, that they felt that they could have benefited from better career advice. We recommend that the department seek to provide this.

The Mathematics and Statistics Institute

We recommend that the services provided by this Institute be expanded and that such services by members of the faculty be appropriately recognized and rewarded.

Recommendations to the Administration

We recommend that the senior administration clarify their expectations of members of the faculty of the Department of Mathematics, specifying their twin roles as teachers and researchers; and enlarge the faculty so that the teaching load may be adjusted to make effective mathematical research possible.

We recommend that the senior administration take immediate steps to reduce its dependence on the employment of adjuncts in teaching.

We strongly commend the viewpoints adopted by the local consultant and endorse her recommendations.

General Remarks

Obviously the main issue that arose, and that must concern the administration of the university and the Board of Regents, is that of the establishment of a Ph.D. program in mathematics. Let us, however, first address other questions of importance.

Our overall impression was highly favorable and there has undoubtedly been substantial significant progress since the last review. There has been an advance in both the size and quality of the faculty of the department; the appointments made have been very good ones, bringing to the campus mathematicians able and willing to contribute to both the teaching and the research mission of the department. The leadership of the department is in excellent hands, and it is pleasing to report the obviously close and effective relationship which the chairman has established with the senior administration, while enjoying the confidence of his faculty colleagues. Current students and alumni testify to the high quality of the instruction received, the availability of the faculty, and the good advice received with respect to education and career options. The service courses are taught with enthusiasm by all involved, including those most active in research. The undergraduate programs are good, and curriculum changes have been made in the right direction. The master's program is plainly fulfilling its purpose. The department enjoys good

relations with other departments and schools. There is an active colloquium program, supplemented significantly by an imaginative Distinguished Lecture series.

The department has established excellent relations with local high-tech industry and the formation of a Mathematics Advisory Group, comprising, in the main, representatives of those industries, is a very enterprising and promising innovation. It is plain that there is strong support from local industry for the progressive upgrading of the department.

A further activity of the department which redounds greatly to the credit, and the prestige, of the university is that it edits and publishes an extremely respectable, internationally recognized mathematical research journal, the International Journal of Mathematics and Mathematical Sciences. Indeed, the chairman of the department, despite the heavy duties of his office, acts as principal editor of this journal and has appointed an impressive list of cooperating editors. We feel sure that the administration appreciates the role this journal plays in enhancing the reputation of the university, and would expect it to accompany this awareness with an appropriate measure of financial support to help to meet publication costs.

The administration has shown its awareness of the key role of the department, in service teaching and in its undergraduate major and graduate programs, by making new lines available, and it is to be hoped that the department can meet its service obligations within the guidelines on class size in the very

near future. However, it is pertinent to emphasize that there is no case for seeking to appoint new adjuncts or new faculty exclusively concerned with teaching. The department has reached a level of maturity and achievement at which such appointments are inappropriate.

The Projected Ph.D. Program

The previous reviewers concluded that the time was not yet ripe for a Ph.D. program in mathematics at UCF. Whatever the merits of that recommendation, on which we pass no opinion, we can now state firmly and unequivocally that, in our judgment, a Ph.D. program in mathematics should be put in place at UCF as soon as possible. The faculty of the department has grown in quality and quantity; moreover, new appointments have been made with the Ph.D. program in view - while at the same time bearing in mind the totality of responsibilities of the department. The initiative for such a program has the strong support of key figures in local industry, who anticipate being able to provide a steady supply of Ph.D. students through the offer of a year's leave of absence on half-pay to bright young employees who already hold the masters' degree. (It is interesting to comment that the Orlando area is becoming one of the principal centers of high-tech industry in the country, perhaps third only to the Silicon Valley and Route 128 round Boston; those centers certainly benefit from thriving Ph.D. programs in mathematics in their immediate neighborhood.)

To build the program and ensure its growth and development, it would be very desirable that the department make at least one or two senior appointments of outstanding researchers of established reputation. A possible mechanism for achieving this would be to establish an endowed chair; many mathematicians, of high caliber, may be attracted more by the prestige associated with such a chair than by a very large salary.

Naturally, the institution of a Ph.D. program presupposes the continued support by the administration for the scholarly activity of the faculty - support to attend meetings, to invite colloquium speakers, to invite longer-term visitors, and to maintain a good library service. Our conversations with senior administrators at UCF reassures us that they will support this new Ph.D. program to the maximum extent possible.

UCF is currently in the anomalous position of having Ph.D. programs in computer science and in physics but not in mathematics. This unique position is plainly only an interim measure, for it is fraught with absurdity. The mathematics department, in its service capacity, must provide advanced graduate courses in various areas of mathematics (algebra, complex variables, differential equations....) for Ph.D. candidates in computer science or physics - yet is denied the chance to prepare its own students for doctoral work through these same courses.

We would envisage, initially, a limited Ph.D. program in mathematics, confined to certain specific areas of mathematics. In fact, we recommend that the program should start as a program in applied mathematics. We do not at all advocate that this restriction appear in the title of the program, since, in the natural evolutionary growth of the program, there will certainly come a time when other aspects of mathematics will be added to the program. Moreover, we believe that the department must provide advanced graduate courses in the core areas of mathematics - real analysis, abstract algebra, linear algebra, topology - even if it is not contemplated that students will wish to write their theses in these areas in the first years of the program.

Faculty Salaries

A final point concerns faculty salaries. These are unacceptably low in relation to the national averages and we recommend that steps be taken immediately to improve them. The aim should at least be to bring them into line with national averages.

FLORIDA INTERNATIONAL UNIVERSITY

General Remarks

This report is bound to emphasize problems, since the problems were so conspicuous and unmistakable. Principal among them, and requiring urgent attention, is the low morale of the faculty of the department of mathematics. The department has a very low self-image, leading them to doubt their capacity to recruit new mathematicians of quality, and thus causing a lack of faith in the future and a serious instability among the most active members of the faculty, many of whom would be very much interested in leaving. This low self-image has many causes. The department sees itself as held in low esteem by the rest of the university and by the administration in particular. We must remark here that we had some evidence to support the department's opinion. With the conspicuous exception of the Dean, our visit to the campus was apparently regarded as a non-event by the senior administration, who evinced no interest in consulting our opinions.

Salaries of mathematicians are inexcusably low in relation to national averages and there are no full professors in the department. These factors contribute to the low morale of the faculty, who have a clear impression that they are not highly rated either by the administration or by their colleagues in other departments. The former impression accords with that which we ourselves formed; as to the latter, we would set in

evidence the remarkable fact that the Mathematics and Statistics Learning Focus group, composed of faculty from various disciplines, made an important recommendation relating to the mathematical requirements of students although that recommendation was opposed by the only two mathematicians who were members of the group. We would also add that we received the strong impression during our site visit that the self-image of the department had been very adversely affected by the prevailing climate of opinion.

The faculty has a heavy teaching load, at a level clearly inhibitory to effective research - though the urge is not completely crushed, by any means - yet promotion is largely based on research output. The usual "perks" of the profession - travel money, sabbaticals, summer support (for research, not extra teaching), colloquium funds, funds to make visiting appointments - are available only in unacceptably low amounts, thus increasing the sense of the faculty that, for all the talk of scholarship and research, they are seen essentially as teachers, and, moreover, teachers whose principal concern is the teaching of elementary and lower division courses. In this connection, we would like strongly to support Recommendation 2 of the local consultant.

To revitalize the faculty and restore their self-esteem steps should be taken along lines indicated by the remarks above. It is also necessary to invigorate the M.S. program, and here an anomalous situation exists requiring immediate

attention. The faculty has developed largely in two areas of pure mathematics, namely, harmonic analysis and logic. Other areas are represented, but applied mathematics - legitimately, in view of the size of the department and the need to create clusters of specialists - has not been emphasized. It is thus absurd that the M.S. should have a predominantly applied focus. This prevents the faculty from making a maximal contribution to the program, and prevents the faculty, too, from deriving maximum benefits, in terms of stimulation and enhanced activity at the graduate level in their own areas of expertise, from the program.

Certain other points should be addressed; the local consultant has given them careful attention and we strongly endorse his recommendations. We will be content to add the following remarks to give added emphasis.

Student Advising

Currently this is unduly decentralized, and this makes for particular difficulties for students who have not yet chosen a major. There should be a college-wide General Advising Service, with access to a SASS outlet. Of course, the department should run its own advising service for majors.

The Value of a Bachelor's Degree in Mathematics

The administration should take strenuous steps to spread the word - especially among high school students - about the

viability of a bachelor's degree with a major in mathematics. Moreover, the program at FIU received strong endorsement from alumni and current students, so that such a campaign, effectively handled, would benefit students, faculty, and university.

Faculty Profile

As indicated above, the faculty clearly does a very good teaching job. The burden is shared by all the faculty, including those most active in research. Several faculty have made research contributions in major journals. Scholarly activity also is reflected in the department's success in organizing and supporting a logic conference this year. These accomplishments further reinforce the consultants' impression that the department underrates itself and is underrated by the rest of the university.

The university should move to reduce the dependence on adjunct faculty and should not appoint anybody not expected to be active in research. This recommendation is made without prejudice to those currently on the faculty who are doing an excellent job of teaching but are not active in research.

UNIVERSITY OF NORTH FLORIDA

General Remarks

Our impression, based on several conversations and consideration of the self-study, was highly favorable. It is clear that the mathematics faculty is doing an excellent teaching job in all its broad aspects. Indeed, it received strong endorsement from all parts of its constituency - from students (both mathematics majors and electrical engineering students), from graduate students, from allied departments, from the College of Education and Human Services, from the Duval County Public Schools, and from Florida Community College at Jacksonville (FCCJ). It is further clear that much credit is due to the enlightened leadership the department has enjoyed over the years - from its present and immediate past chairman - and to the excellent relationship existing between the department and the senior administration.

However, naturally and inevitably, there are problems, which we discuss below. We have confidence that the general goodwill and good sense we observed will ensure that solutions to those problems will be found. We begin with an easy problem!

S.I.R.

It appears that S.I.R. reports may be misused in the procedures on promotion and tenure. It is recommended that

this issue be carefully examined to ensure that the integrity of the decision-making is not compromised.

Graduate Program

This program is currently too small to be viable, yet there is a need for a master's program and great enthusiasm to participate in it. The program desperately needs more TA's - such an improvement would also, of course, have a very beneficial effect on the heavy faculty teaching load. Also it may be possible for the administration to assist by streamlining application procedures - we were informed, for example, that all applications must be accompanied by a $15 fee, clearly an insurmountable barrier to most students from mainland China.

Release Time for Faculty

The members of the department are to be commended on the great amount of time they devote to helping students. However, such conspicuous service is bound to be at the expense of their own innovative and creative work. It is thus important that the faculty reach a size where it becomes possible to offer additional release time to those engaged in research and other forms of original work. We stress here that innovative thinking in the area of curriculum development should certainly be considered in this context. A reform is taking place in the core calculus program in this country and UNF certainly has

mathematicians on its faculty who are concerned with such curricular innovation.

Salary Problem

Salaries are low, according to data provided by the American Mathematical Society. There is also - as on other campuses of the State System - a serious problem of salary compression, leading to glaring inequities. Of course, these problems cannot be solved overnight. But we strongly recommend that the university develop a long-term strategy to address this issue and ensure that the faculty are aware that the problem is recognized and understood, and that steps are being taken to redress the imbalance.

Departmental Needs

Many faculty members today use word-processors themselves to produce their own manuscripts. However, this practice is certainly not universal, and a faculty member should not be expected to do his/her own typing; nor should there be a penalty for those who do not, beyond having perhaps to queue for secretarial service. We recommend that a secretary capable of typing mathematical manuscripts be appointed.

A faculty lounge, provided with blackboards, is part of the essential equipment of an active mathematician - quite as essential as a laboratory is to an experimental scientist. There mathematicians can occupy their time profitably in

vigorous discussion, thus generating new ideas both for teaching and for research. We recommend that a room be made available to the mathematics and statistics department and equipped as a faculty lounge.

PART II STATISTICS

Statistics: An Overview of the Discipline

Statistics as a distinct academic field in U.S. universities has a history of only about fifty years. Many land grant institutions developed Statistics programs in response to the needs of agricultural scientists and their graduate students for efficient experiment design and data analysis. The statistical methods included were based on experience and intuition and on a theory that began to be synthesized around the turn of the century. That theory provided a mathematical foundation to justify, and against which to evaluate, those methods. Academic programs in Statistics are based on a background in mathematics and probability, often combined with associated knowledge in such fields as engineering, the physical, biological, and social sciences, and the humanities. A statistician considers various courses of action under conditions of variability and uncertainty of response. He or she assists in the design of experiments and surveys, the analysis of the resultant data, and the preparation of conclusions and proposals for future courses of action. Statistics is usually divided into theoretical and applied statistics, but the distinction is often blurred; every applied statistician should have a solid foundation in theoretical statistics, and theoretical statisticians need to have an appreciation of the prospective impact of their results in the real world.

As academic Departments of Statistics were formed and then matured, there was a tendency to move away from the applied roots of the subject and toward research into its mathematical theory and philosophical foundations. Academic statistics became increasingly a branch of mathematics. Recently, there has been a swing back toward the traditional motivations, and mathematical statisticians are intimately involved in the development and application of statistical methods to important problems in health, the environment, industrial quality assurance, public policy, and other areas. Indeed, a recent self study of the profession by a panel of the Institute of Mathematical Statistics concludes that the discipline should direct its energies toward cross-disciplinary research.

The importance of statistics as a discipline has increased in recent years because of:

(1) the recent development of high tech industries and the need for better methods of statistical quality control;

(2) the need to develop procedures to assess the environmental impact of industrial and other developments;

(3) the rapid expansion of the drug industry and the demand for better control of the usefulness and side effects of drugs;

(4) the need to feed an increasing population;

(5) the increased importance of local, national and international statistics in formulating executive, legislative, and judicial policies.

Unfortunately, few members of the general public recognize these roles of a statistician. The public perceives the statistician as a "number cruncher" - a compiler of baseball, football, basketball, track, and other sports records, Dow Jones stock averages, etc. Another impediment to the representation of statistics as a unique scientific discipline is the fact that in the Statistical Abstract of the United States, statisticians are not separately designated but are included in the general classification of "Mathematicians" or "Mathematical Scientists."

Because most universities regard statistics as one of the mathematical sciences, procedures for evaluating the performance of statistics faculty members tend to follow those for mathematicians, with heavy emphasis on published research; minimal importance is assigned to consulting activities. However, consulting activity in statistics is quite important; statistics is an integral part of the scientific method and statistics is essentially the servant of the sciences. Consulting is a legitimate scholarly activity for statisticians.

To combat misconceptions and to further its goals, the statistical profession should:

(1) develop procedures to teach statistical concepts in our elementary and secondary schools as well as the universities;

(2) encourage government agencies to require sound statistical training as a qualification for being classified as a statistician;

(3) encourage the evaluation of academic performance utilizing statistical consulting performance;

(4) insist that statistics courses in universities be taught by qualified statisticians, and encourage the development of statistical programs with adequate personnel to accomplish this; and

(5) explore means of increasing the number of undergraduate and graduate students in statistics and related areas.

National Needs for Statisticians.

In the 1985 report of the 1984 review of Statistics programs in Florida, the NSF Publication 80-78 (October, 1980), Science and Engineering Education for the 1986's and Beyond was cited. A table from that reference titled "Comparison of Projected Job Openings with Projected Degrees in Science and Engineering, 1978-1990" was reprinted in the April 1981 issue of Amstat News (page 5). This table separates Statistics from the other Mathematical Sciences. It states that there would be approximately 19,000 job openings for statisticians in the 1978-1990 period, whereas there would be only about 8,000 graduates with Baccalaureate and Master's degrees. The same Amstat News compiles a list of Statistics graduates each year for every university and college offering programs in

Statistics. The basic numbers for three years in the past decade are:

Year	Ph.D	MA-MS	AB-BS
82-83	323(8)	1,032(39)	945(26)
85-86	320(11)	1,060(27)	1,263(48)
88-89	340(4)	1,147(32)	959(23)
Average	328(8)	1,080(33)	1,056(32)

The numbers in parentheses refer to Florida graduates. The average number of graduates in all Southern universities during the three years were 92, 269, and 243 respectively (about 25% of all graduates). It should be emphasized that the total number of individuals available for employment will be less than the sum of the three groups of graduates, because AB-BS students often proceed to the MA-MS program and these in turn often proceed to the Ph.D. Nevertheless
it appears that the universities and colleges are contributing more than the NSF projected in 1980. However, a disappointing aspect of these data is the small number of Statistics students graduating from Florida universities.

The Southern Regional Committee on Statistics frequently distributes a bulletin on Statistics Programs in the South. The table below summarizes the number of graduate and undergraduate students enrolled in statistics programs in 17 universities in the South, for six time periods:

YEAR	GRADUATE			UNDERGRADUATE		
	ALL	FSU	UF	ALL	FSU	UF
1969	545	45	19	189	15	8
1971	615	50	24	218	15	5
1975	644	55	35	192	12	10
1977	674	50	35	175	22	15
1985	558	35	38	177	13	43
1990	711	30	50	331	9	60

Note that these are numbers of students, not graduates.

These data indicate that the Southern Universities are emphasizing their undergraduate Statistics programs much more than in the past. The University of Florida is a leader in this development; its former Statistics Chairman has been a leader in a Quantitative Literacy program aimed at developing materials and procedures for introducing statistical concepts into elementary and secondary education programs.

Even though the number of Statistics graduates seems to be larger than projected by the NSF in 1980, this number is still much smaller than is needed by universities, industry and government. In the 1985 review report, the recommendations listed below were aimed at increasing the pool of statistics graduates being produced in Florida. They are still valid today.

(1) Increase the emphasis on undergraduate programs in statistics, perhaps under the umbrella of mathematical sciences.

(2) Recruit undergraduate majors in the physical and engineering sciences to pursue graduate work in statistics. Although these students will have a good undergraduate mathematical background, it may be necessary to modify the advanced mathematics requirements to persuade them to switch to statistics.

(3) Recruit undergraduate majors in the biological and social sciences into graduate statistics programs, although deficiencies in their undergraduate mathematics backgrounds would almost certainly require modification in statistics graduate program requirements.

(4) Develop more flexible course requirements so that undergraduate statistics majors can select a variety of statistics courses and still have time to elect courses in operations research, computer science, and the natural and social sciences.

(5) Develop consulting programs that involve graduate students, and encourage statistical research projects that are devoted to the solution of real world problems.

(6) Develop more biostatistics programs and programs that emphasize statistical computing.

Statistics in the State University System of Florida: Overall Remarks

The University of Florida's Statistics Department is developing a strong undergraduate program and it, along with the Department of Statistics at Florida State University, have excellent graduate programs which offer Master's and Ph.D. degrees. These two departments teach most of their universities' service courses in Statistics, and provide excellent consulting services. Two other state universities have Statistics Departments which offer B.S. degrees in Statistics: University of Central Florida (which also has a M.S. in Statistical Computing) and Florida International University. The UCF Statistics Department offers many service courses, but the Colleges of Engineering and Business have their own Statistics courses. The FIU Statistics Department offers most of the university's Statistics service courses, but the College of Business now wishes to teach its own Statistics courses there.

The University of West Florida and the University of North Florida each has a Department of Mathematics and Statistics. The University of North Florida offers a bachelor's degree program in Statistics, and a Statistics track at the Master's level, while the University of West Florida has statistics tracks at the bachelor's and master's levels in the Mathematics

degree programs. Both departments teach most of the Statistics service courses and offer statistical consulting service.

The other three State Universities (Florida A&M, Florida Atlantic, and South Florida) do not have formal Statistics programs; Statistics service courses are taught in the Mathematics Department or elsewhere on campus. FAMU has secured a good statistician and one of its other faculty members is completing a M.S. degree in Statistics; the department teaches Statistics service courses, but there is course duplication by Education and Business departments.

USF had a good Statistics program in the late 1970's (at least 10 Ph.D.'s), but most of the Statistics courses now are taught by Engineering, Business, and Social Science departments; there is little, if any, statistical consulting from the Mathematics Department.

FAU is finally realizing that it needs a strong Statistics program, as shown by the fact that a Task Force on Statistics was appointed in December, 1989, and reported in January, 1990. The Task Force recommended the establishment of a Committee on Statistics to review statistics offerings and consider the development of a statistics concentration; at present, the Mathematics Department pays little attention to Statistics.

From this brief outline it is apparent that there is a need for a serious assessment of statistical programs at many of the State Universities in Florida. Unfortunately two of the most densely populated areas in Florida (the Tampa-St. Petersburg

and Miami areas) have small (if any) undergraduate and no graduate statistical programs; the situation is not much better in the rapidly developing Orlando area, where the UCF Statistics program is floundering.

There is no evidence that the Board of Regents Master Plan for 1988/89 through 1992/93 provides for any new or enriched programs in Statistics. It is imperative that an effort is made to make administrators and politicians aware that a strong Statistics program is an essential ingredient in any research program which involves the collection and analysis of data.

In the 1985 review report, a number of additional general comments regarding the statistical programs in the State University System (SUS) of Florida were made that still apply today. They are:

(1) Statisticians should be teaching statistics courses. This principle is being violated on many SUS campuses where some disciplines still insist upon teaching statistics courses, even when there is a qualified statistical faculty available.

(2) Undergraduates in all disciplines should be made aware of the need for good statistical procedures in the acquisition and analysis of data.

(3) Good statistics service courses for other disciplines should be offered by statistics faculties at all universities.

(4) Joint programs between statistics and other departments should be encouraged.

(5) Some masters programs in statistics are needed in the System, even if such programs do not lead to the Ph.D.

(6) Solid Ph.D. programs in both applied and theoretical statistics are available at UF and FSU; and they should continue to have the primary statistics graduate programs in the SUS.

(7) The two large population and industrial centers of Miami and Tampa should each have a strong applied statistics program; at the moment, neither has the faculty or resource commitment for more than undergraduate and masters programs. Even for these programs the present commitment is incomplete, since many statistics service courses are not being taught by statistics faculties.

(8) The other four universities where statistics faculty teach most of their statistics service courses (FIU, UCF, UWF, and UNF) should continue with bachelors and masters programs, but not consider Ph.D. programs for the time being.

Finally, there are a number of fiscal and logistical problems which many or most of the SUS Statistics programs face, viz.,

(1) Low faculty and graduate assistant salaries. The salary scales for many of these programs are in the

lowest quartile (often at the lower end of the quartile) of salaries at institutions in other states. Appendix D provides the results of a salary survey presented in AMSTAT NEWS, December, 1989.

(2) The salary problem is compounded by the so-called "compression" problem, i.e., the need to offer higher salaries to acquire new faculty members than the salaries of many existing faculty members.

(3) Inadequate funds are provided for secretaries and other support staff members.

(4) The universities provide inadequate current expense funds for travel, sabbaticals, recruiting faculty and students, visitors and seminar speakers, and supplies.

(5) Procedures for promotion and tenure penalize faculty members who devote a substantial amount of effort to collaborative research (consulting with research colleagues).

(6) There is a shortage of space, resulting in faculty members and graduate students having offices in widespread campus buildings.

(7) The scarcity of good American graduate students hampers the development of programs.

(8) A common complaint of department chairs was the delay from the time at which appropriations are made and when allocations from them achieve certainty. The budgetary

uncertainties arising from Florida's legislative schedule should not be projected down to the departmental level.

UNIVERSITY OF FLORIDA

The Statistics program at the University of Florida was started to provide teaching, consulting, and collaborative research in Agriculture. Over the years, the program has grown and changed; today the department offers a well-rounded program serving the entire University as well as fulfilling its original mission. For a brief history of the department, see the 1985 Mathematics and Statistics Program Review.

The statistics faculty share a common vision of the department as striking a healthy balance between theory and applications and also among teaching, research and statistical consulting. While continuing to place high priority on teaching and consulting, the department has increased its emphasis on research.

Research contributions in statistics can be grouped into three categories. First, there are ones that advance statistical theory and methods; these generally appear in statistical journals. Then there are ones that make primary contributions to other disciplines, and appear in the literature of those disciplines. In this second type, the statistician must have achieved a substantial level of knowledge in the application area. Some notable examples are research in quantitative genetics, econometrics and wildlife biometry. In its most highly developed form, such work could not proceed without the involvement of both the statistician

and the subject matter scientist. This represents true collaborative, cross-disciplinary research.

The third class of contribution includes work which is the result of consultation by statisticians with subject matter scientists on matters of experimental design and data analysis. These, too appear in subject matter journals; but from a statistical perspective they are often more "routine" than collaborative research. It is this work which is typically identified as "consulting."

As noted earlier, a healthy department produces all three types; the specific mix determines the "flavor" of the department. The Statistics Department at UF is healthy, and is one of the leading statistics departments in the nation when compared with other departments with the same mix. However, the department needs to recognize that a program which emphasizes cross-disciplinary collaboration is unlikely to achieve a strong reputation in the statistical community, which tends to emphasize the importance of individual research. Graduates from programs such as the one at UF tend to move to industry and government; as a result they are likely to publish much less frequently in statistical journals than will graduates who enter the academic community. Nevertheless, the consultants concur with the department that a mix of theory and applications is appropriate, and is consistent with the recent recommendation of a panel of the Institute of Mathematical

Statistics calling for the increased involvement of the discipline in cross-disciplinary research.

The department has a complex structure which involves reporting lines and funding through three units of the university: the College of Liberal Arts and Sciences (CLAS), the Institute of Food and Agricultural Sciences (IFAS), and the J. Hillis Miller Health Center. CLAS is the focus for teaching and degree programs and for a wide range of research in statistics. Statistics faculty supported by IFAS provide advice to IFAS scientists on experiment design and data analysis, and conduct research on statistical methods which have application in the agricultural sciences. Statisticians housed in the Health Center provide similar advice and assistance to the university's medical research enterprise. In addition, the Department of Statistics is the administrative home for the statistical office of the international Pediatric Oncology Group.

The complex administrative structure offers challenges, and could be unstable were it not for the commitment to cooperation existing among the leadership of the three units. Deep cross-disciplinary ties are the hallmark of strong applied Statistics Departments, and the present administrative arrangement should be viewed as an asset. The consequence of this strong interaction among three academic units is that statistical counsulting and collaborative research are (properly) included by UF

among the criteria used in evaluating statistics faculty for promotion and tenure.

There is a serious morale problem in the biostatistics division which can be resolved only by the appointment of a dynamic and visionary permanent director. There are several fundamental issues facing the division: stable funding; tenurability of Ph.D.-level positions; research and degree programs in biostatistics; space and other physical resources; and its administrative relationship to the Department of Statistics, CLAS, and the Health Center and its constituent Colleges. A more stable structure might result if the division reported through the College of Medicine rather than through the umbrella of Health Affairs Administration. The disturbing issue of tenure might be resolved more effectively at a College level.

The Health Center administration has received mixed reports about the quality and availability of statistical services being provided by the biostatistics division. There is evidence that some potential clients are obtaining statistical advice elsewhere--it may be worthwhile to evaluate present client satisfaction and to survey Health Center researchers in order to estimate unmet needs. If time is available, a program of education for Health Center researchers on the role of biostatistics should be fruitful.

Although the IFAS Statistics group appears to be well integrated into the Statistics program, the department might

find it beneficial to explore the idea of creating joint faculty appointments in CLAS and IFAS. This arrangement would provide CLAS faculty greater opportunity for collaborating with food and agricultural scientists, and IFAS faculty would find their CLAS colleagues more accessible for joint research or curriculum innovation.

There is good cross-unit attendance at departmental meetings, seminars and other activities; however, something like a departmental newsletter might improve communication among the three groups. Also, Department members should be urged to become regular users of electronic communication with one another.

There are other ways in which the department can become stronger; a few comments are presented in the following.

(1) The department should initiate a search for a graduate research professor in addition to seeking a senior-level director for the biostatistics division.

(2) Since NSF funds for applied statistical research are becoming more difficult to obtain, UF should increase its efforts to obtain research support from agencies involved with such areas as economics and population biology.

(3) The department should make more time available for research for those members most interested and capable of conducting it. This could entail reallocating teaching loads to increase those of good teachers who

are less interested in research. At UF, where good statistics teaching has always been respected, this should be less difficult to achieve than it would be in many statistics departments.

(4) Additional financial support is needed for: more GTA's to be used as graders; faculty time to recruit students (both graduate and undergraduate); increased faculty salaries (especially to correct the compression problem); and, additional staff to maintain, manage and plan for the department's computing and communication needs.

(5) The department has an obvious shortage of space, even though improvements have been underway since 1985; this shortage is especially evident in the biostatistics division.

(6) The university and department should consider whether the IFAS and CLAS faculty should be housed together.

(7) As the nature of university computing evolves, so must the mechanisms for its funding. In particular, the move away from mainframe computers needs to be accompanied by a reconsideration of the distribution of funds for computing. As desktop units have become capable of larger scale computations, and as networking has facilitated data transfer between client and statistical consultant, desktop systems have become more attractive.

(8) As noted earlier, there is a long tradition of excellent statistics instruction at UF, and student opinion of its quality remains high. In view of its history, the UF is a natural environment in which to develop an even stronger reputation in post-secondary statistics education. The department should adopt and pursue such a goal.

(9) The department should add a regular graduate course in statistical computing, and should consider the feasibility and advisability of including a consulting requirement for all graduate students.

(10) As this department moves towards a goal of increased national prominence, it will be increasingly attractive to potential graduate students. To take advantage of this, certain basic steps should be implemented at once: prepare and disseminate recruiting materials to a wider audience, including undergraduates in engineering, biological and social sciences and economics; secure assistantships and fellowships with higher stipends; increase numbers of tuition waivers; and, bring prospective students to campus for interviews.

(11) Increase the number of undergraduate majors by using some of the procedures mentioned above. It also might be useful to establish an undergraduate club. A carefully planned program of advertising in the

community colleges and high schools with selected faculty visits to "career days" should be productive, as well.

(12) The department should consider instituting a consulting center, funded by the University, to provide consulting services across the campus. In addition to providing service to other disciplines through the consulting, this device also identifies important research problems for statisticians. [Statistics is an interactive science - it cannot be practiced outside of the context of some other field.] Finally, an active consulting program provides apprentice opportunities for students seeking to become professional statisticians.

The regular appearance as coauthors on works in subject matter literature suggests that the consulting provided by the UF statistics faculty is valued by their collaborators; and also that the work is valued by editors of those journals.

(13) The size of the research program at Lake Alfred justifies locating a full-time statistician there.

FLORIDA STATE UNIVERSITY

The Statistics Department at Florida State University (FSU) is outstandingly good. In the national Research Council's 1982 survey of earned doctorates, An Assessment of Research Doctorate Programs in the United States it ranked at the head of the 41 rated programs in the State University System of Florida. Since 1985, only two faculty members have left the program (one because of impending non-promotion to tenure); at the same time, one very strong senior appointment and several quite solid junior appointments have strengthened the faculty, both in breadth and quality, beyond its 1985 strength.

FSU has outstanding Ph.D. programs in theoretical statistics, probability theory, stochastic processes, operations research, reliability theory, biostatistics and applied and computational statistics. There is a small undergraduate program (which should be expanded), and a masters program which has two directions - one leading to further study toward the Ph.D., and the other leading to industrial employment. A Reliability Center in the department, sponsored by the Air Force Office of Scientific Research, conducts basic and applied research in reliability and acts as a resource for Air Force personnel.

Statistics is essentially an outward-looking, interactive discipline. We note with marked approval the strong presence of applied statistics activity among the faculty, and in the

programs of the department. Inquiry showed that the Statistical Consulting Center has had numerous clients among state agencies, including the Department of Health and Rehabilitative Services, the Health Care Cost Containment Board, the Department of Transportation, the Department of Education, Capital Collateral Representatives, and the Department of Insurance. Additionally, there are strong continuing collaborative links inside the University, with the Department of Biological Sciences (including a 10-year interdepartmental weekly seminar) and with the Schools of Business and Education. Such persistent involvement by a Statistics Department in real-world problems is highly commendable and is very good for graduate programs. We offer some suggestions below for strengthening the department and its service to the university.

(1) Measures should be taken to increase enrollment in the department. There should be summer support funds for graduate student consulting as well as teaching. With so good a program, additional fellowships, teaching assistantships, and research assistantships would be well-invested by the university. In addition to raising the level of doctoral student stipends (by at least $1,000 per year), the university should seek to provide summer support for research assistantships in the statistical consultation group.

(2) The Statistics Department should consider teaching the measure theory their students need and needed allied topics as a part of the instruction in the advanced probability course they offer. There is some concern that the measure theory needed by statistics graduate students is included in a graduate mathematics course, much of which is geared toward pursuing doctoral mathematics rather than statistics study.

(3) The Department might benefit from reinstating the position of Associate Chairman.

(4) The university should increase its awarding of sabbatical leaves. These refresh the faculty member, and at the same time provide the opportunity for the department to infuse new enthusiasm in the form of a temporary commitment from outside the university. There are several cost-effective approaches available--the administration must be convinced of the value of this endeavor.

(5) The Department has acquired greatly-expanded computing resources to serve faculty, students, and administrative support staff; the policies governing allocation of these resources and access to them are still being determined. An intra-departmental committee drawing from all three groups served could expedite the process and arrive at a well-brokered and superior disposition

of these resources, acceptable to all. Space is needed for student use of computers.

(6) The salaries for junior faculty are low in comparison with national data.

(7) It was suggested in the March 1985 Program Review that efforts be made to promote joint programs in quality and productivity with the Colleges of Engineering and Business. This has not been accomplished, and we recommend renewed efforts in this regard.

FLORIDA A & M UNIVERSITY

There is no degree program in Statistics at FAMU. The Mathematics Department offers several sections of STA 3023 and STA 3024 (an introductory statistics course); however, statistics courses are also taught in the School of Business and Industry and in the College of Education. In its response to the 1984-85 Program Review, it is stated, "The University is starting to investigate the problem of course duplication, in general, and the issue of statistics courses will likely be examined." The ability of the Mathematics Department to teach these courses has been materially enhanced by the employment of one new Ph.D. in Statistics and the completion of an M.S. in Statistics by another Mathematics faculty member. With the addition of two faculty members qualified to teach statistics courses, every effort should be made to transfer statistics courses from Business and Education to Mathematics. It is suggested that a committee headed by a representative of the Mathematics Department be appointed to supervise the transition. This must proceed slowly in order to accommodate the present teachers of the relocated courses, but all such courses ultimately should be identified as statistics courses.

The Mathematics Department is to be congratulated for developing a B.S. in Mathematical Sciences which utilizes all five of the present Statistics courses. As statistical training receives emphasis in our secondary education courses,

it will become important to teach at least two statistics courses in the mathematics teacher certification program. FAMU has made a very wise decision to add an Actuarial Science track to its BS degree in mathematics; this track should be highly publicized.

We recommend that FAMU proceed as rapidly as possible to increase the emphasis on research in its academic programs. As this develops, the statistics faculty will become important members of research teams; statistical consulting and collaborative research will become essential. Both of the current statistics faculty can serve in this capacity; however, additional applied statisticians will be needed in the department. As research develops at FAMU, computing facilities must be improved. It may be desirable to develop a Statistical and Computing Consulting Center.

A number of concerns were noted:

(1) The need for increased financial support for students, especially undergraduate assistantships and scholarships;

(2) Depressed faculty salaries, and limited opportunities for professional development and growth;

(3) Inadequate classroom space, and too large classes;

(4) Inadequate office space;

(5) Insufficient funds for supplies, current expenses, and travel to professional meetings; and,

(6) A home for the Mathematics Department.

When statistics becomes an important element in the Mathematics Department, FAMU should consider changing the name to the Mathematics and Statistics Department, or the Department of Mathematical Sciences.

UNIVERSITY OF SOUTH FLORIDA

Statistical training at the University of South Florida has become entangled in internal conflicts among faculty, and administrative malaise. The Mathematics Department, which administers the modest statistical program offerings at USF, has only three statisticians. Of these three, one has refused to direct any more graduate students; prior to our 1984-85 Program Review, he had directed 11 out of the 31 Ph.D.s in Mathematics granted at USF up to that time. From 12/83 to 7/89, there have been four statistics Ph.D. dissertations, all directed by one faculty member, who also edits a new journal, the Journal of Theoretical Probability. There is no evidence of a concerted effort to recruit graduate students who would concentrate in Statistics or Probability; however, the University catalogue lists 11 graduate and 5 undergraduate courses in these areas. The only substantial enrollment is in six service courses; unfortunately there continues to be considerable duplication of these courses in Engineering, Business, and Social and Behavioral Sciences.

The Mathematics Department would like to develop a Statistics program, but only if a sufficient number of new faculty members in Statistics and Probability can be obtained. There had been strong efforts prior to the 1984-85 Program Review, to develop Statistics graduate and service programs, but apparently these are no longer being actively pursued. The

most disappointing development has been the omission of statistics in the program of the Center for Mathematical Services. A very important aspect of applied science is the use of statistical concepts in the planning, development and analysis of scientific experiments. According to the statement on page 8 of the Fall, 1989 Self Study for the Department of Mathematics at USF, "the CMS conducts five programs in mathematics, science, engineering and computer science for gifted and high achieving secondary school students." It is unfortunate that Statistics is not included in this statement, also. Prospective university students should be taught basic concepts of statistics and their use in scientific research.

It is evident that USF desires to join Florida State University and the University of Florida as a recognized, outstanding research university in the SUS of Florida; however, an examination of the present employment of its Ph.D. graduates in mathematics and statistics indicates that USF has a long way to go before its mathematics program will be an outstanding one. It is disturbing that the department and the administration do not seem to recognize that a strong broadly based statistics program is as important as mathematics in this development.

The following steps are recommended to bring Statistics at USF into proper perspective:

(1) Change the Mathematics Department to a Mathematics and Statistics Department, or establish a separate

Statistics Department. Either procedure will require the employment of at least three additional statisticians, primarily in Applied Statistics areas and including at least one who is highly recognized by the statistical community. This latter person should be put in charge of the Statistics program.

(2) At the same time that new statistics faculty members are being acquired, the other departments teaching Statistics service courses shall be told that these courses will be taught by the Statistics Department. During the transition, it may be necessary to give the present teachers (outside of the Mathematics Department) joint appointments with Statistics.

(3) A University Statistics Consulting Center should be established, perhaps as a joint effort of the Mathematics and Computer Science departments.

FLORIDA ATLANTIC UNIVERSITY

In the 1984 Program Review, the following remarks appeared:

(1) Statistics as a discipline has been neglected at FAU.

(2) The proliferation of statistics offerings is very unfortunate.

(3) There is a real need for a statistical laboratory for statistical consulting.

In its 1990 Self Study, the Mathematics Department states that "The team's recommendations (1984) on statistics have not been carried out." In fact, the proliferation of statistics service courses has been exacerbated by the Computer Science department's developing and teaching its own probability and statistics course. The university has taken steps to improve this situation; the University Provost appointed a Task Force on Statistics, which has recommended the establishment of a Committee on Statistics to review current statistics offerings and all new course proposals in Statistics, and also to examine the feasibility of developing a statistics concentration.

The Mathematics Department offers an introductory statistics course to mathematics and engineering students, and possibly to some others. In addition to the Computer Science Division, the College of Social Science and the Psychology Department also offer statistics courses; apparently there is no coordination of introductory statistics offerings.

Unfortunately, the Task Force apparently has not addressed

the need for establishing a statistical consulting group. This is extremely important if FAU is to become a leader in scientific research. A great deal of such research requires access to consultants who have solid backgrounds in statistics and applied probability. For example, the Center for Complex Systems certainly should have such expertise available to it. Such a consulting group should consist of statisticians who are trained in experiment design, regression analysis, linear models, quality control, stochastic processes, survey sampling, and time series.

The status of Statistics at FAU underscores the difficulty of developing a statistics program in a Mathematics Department which concentrates on pure mathematics. For FAU to develop a strong applied statistics program, a separate Statistics Department must be established; making the present Mathematics Department into a Mathematics and Statistics Department is unlikely to work. With the present and projected future scarcity of qualified statisticians, the establishment of a Statistics Department will be very expensive; hence, expert consultative advice should be acquired to develop a long range plan. The formation of a University Committee on Statistics will not be a satisfactory substitute.

UNIVERSITY OF WEST FLORIDA

I. Background. According to the departmental review, "The University of West Florida is an urban university with a regional mission." Mathematics and Statistics form the Department of Mathematics and Statistics, administered in the College of Arts and Sciences. Both disciplines are fortunate that the new President of UWF and the new Dean of the College received Ph.D. degrees in mathematics, and that both have strong ties to Statistics.

The Department offers a BA degree with Statistics as one of four tracks, and a MA degree with tracks in Mathematics and Applied Statistics; the current MA program emphasizes mathematical sciences and statistical quality control. Statistical consulting is offered in the Institute for Statistical and Mathematical Modeling (ISMM).

II. Faculty and Facilities. The departmental facilities are dispersed among four locations across the campus. This leads to logistic problems and drastically reduces communication among faculty, and also surely affects productivity in terms of collaborative efforts in research and teaching. Furthermore, adequate space to enable teaching assistants and adjunct faculty to communicate with regular faculty and students appears to be severely lacking. We hope that the university can find a way to rectify this problem as soon as possible.

We were very favorably impressed with the dedication and energy of the departmental faculty. The department is fortunate in having some bright and energetic young faculty. Furthermore, current openings will enable the department to fill areas of greatest need and will ensure continued departmental vitality. It seems clear that faculty size has not increased at nearly the rate of growth in statistics and mathematics class enrollments. In addition, the Gordon Rule on class size has reduced the department's flexibility in accommodating increased lower-division class enrollments.

III. Teaching. All indications are that the teaching load for the department has grown considerably over the last few years, in part due to larger university enrollment at the lower division and the growth in pre-engineering. The existing number of faculty positions is not sufficient to handle the load; hence, a very large proportion of classes are taught by adjunct faculty. Though it appears that TA's are carefully supervised in teaching, it is much more difficult to supervise adjunct faculty and to maintain consistent standards and coverage of material. We believe that this heavy load carried by adjuncts should be of considerable concern, and that regular faculty lines should be increased as soon as possible.

In our discussions with representatives of 'user' departments and with students at both the undergraduate and graduate level, we were left with the clear feeling that

departmental teaching is excellent. The user departments were very complementary of service teaching, and majors felt good about their education in mathematics and statistics. The faculty obviously are dedicated to good teaching.

IV. Degree Programs. Our information from faculty, students, and administrators, along with a review of some specific programs of study suggested that the degree programs are very good. The students we met were bright and very articulate. The MA program seems to be well-conceived; it is marketable and can be handled with existing faculty. However, Statistics might be served better if the degree granted were an MS. We were pleased to see the newly-structured departmental Comprehensive Examination policy for the MA.

The department currently has six TA positions. We believe that the University should give a high priority to awarding additional TA positions to the department. Not only would this strengthen the graduate program, it also would support faculty research and would ease the heavy lower-division teaching load.

Finally, we believe that the department should give further consideration to the feasibility of offering its graduate degree program at Eglin. Such a program could strengthen the department and possibly lead to research grants from Eglin.

V. Research. Research expectations must take into account the teaching and service expectations; however, considering the

work load of the faculty, the research productivity is good. In statistics, the recent research has been published in good applied statistics journals. [Good consulting papers also should be placed in the research category, especially when innovative methodology is used.]

Additional graduate student support would be very useful to help the faculty in their research efforts. Also, increasing the availability of release time for research would enable faculty members to develop new research projects.

We encourage the department to take advantage of the energy and dedication of its junior faculty and to help them develop into both teachers and scholars. Faculty should be encouraged to present papers at professional meetings and the department should receive sufficient operating funds to support such activities.

VI. Service. ISMM offers statistical consulting service to graduate students and faculty across the university. This is a valuable service to the university research community. We understand that the director receives release time only during the academic year. Since research is also conducted during the summer, we believe the director's position should be converted to a calendar year appointment. (This is standard in most universities that offer such a service.) The consulting service would benefit considerably from graduate student support for more routine consultations and for computer

programming. This consulting service is valuable to the entire university research community, and can even be used as a faculty recruiting incentive for other departments. Therefore, it should have an independent budget, drawn from University general funds.

Finally, we suggest that the name of the institute (ISSM) be reconsidered by the department. The current role of the institute seems to be more appropriate for a Center or Laboratory.

VII. General Comments. The University of West Florida has the framework and administrators to develop a strong Statistics program. The Department of Mathematics and Statistics should develop a few key research areas on which to focus. As the university begins to emphasize research, it must clarify its expectations for tenure and promotion. This is essential if it is to obtain and retain young research faculty members. Generally, the department is doing an outstanding job and should be commended.

UNIVERSITY OF CENTRAL FLORIDA

As indicated in the 1985 Program Review, the Department of Statistics (which was organized in 1983) had reached a possible turning point in 1985 because the two faculty members who exerted the major influence on its development would be taking full- or part-time retirement (both have since retired). Unfortunately a clear direction has not been established yet, and the department now has an acting chair assisted by an executive committee. The department has a BS program in Statistics, a MS program in Statistical Computing, and the Institute of Statistics (a consulting group). In addition to eleven faculty positions, there is a position titled Assistant in Statistical Computing, which is assigned to the Institute of Statistics. There are six GTA's, one and one-half secretarial positions, and a student assistant.

Our comments will concentrate on five areas: the department, the undergraduate program, the graduate program, the service program, and the Institute of Statistics.

(1) The Department. The faculty salaries in the Department of Statistics are low in comparison to major universities. The first and most important business for the department is to hire a chairman and then fill all line positions. The Department and the University administration must decide now if the Department of Statistics is to become a major department in the

University, with significant research, contracts and grants, perhaps a Ph.D. program, and the attendant faculty, staff, students, and computing facilities that make for a reputable department. All but one of the senior faculty are retired or retiring, and the chair and several line positions are vacant. If the Department and the University administration decide to have a Statistics department as described above, they should start now, and recognize that it will take 7 to 10 years to build a solid, reputable department and a Ph.D. program. First, a chairperson who is nationally known must be hired. The chair must be promised, and given, the resources to hire three or four additional good Assistant Professors in the next two years. New faculty should be expected to produce research published in nationally recognized journals, and to give leadership and help in developing the department. Existing faculty should be given the choice of joining this group and producing reputable research or working in the Institute, where consulting and publishing applied papers would be amply rewarded. Additional Graduate Teaching Assistants (GTA's) and support staff also will be required. Significant monies from funded research and contracts should be generated.

If the Department and Administration decide that the Statistics Department is not to be a major

department as described above, then a Chair who will improve and increase the undergraduate program and the MS program should be hired.

The decision on departmental direction must be made before a chairperson is hired! The two missions are very different, and the faculty who will be sought will differ accordingly. However, in either case the Institute can play a significant role in the University and the community.

(2) The Undergraduate Program. The undergraduate program is quite adequate and well established. Existing offerings should be maintained, and the program increased to include courses in experimental design and time series.

(3) The Graduate Program. The Master's program in statistical computing should be examined. We are not quite sure what this degree is, but we feel that it should include more imaginative work in computing. The department faculty have ideas how this program can be improved and enlarged. Perhaps a faculty member should be hired who has a degree from a university that gives a Ph.D. degree in statistical computing. This faculty member could be of significant help in developing the program. It will be difficult and expensive to find such a person--perhaps he or she could have a joint appointment with the department of computer science.

(4) Service Courses. Several service courses are offered for students in other departments; the student credit hours in these courses increased dramatically for the Fall 1989 semester. These courses are well taught; however, more resources should be made available since the class sizes are too large. Some statistics courses are taught in the Colleges of Engineering and Business; those should be brought under the supervision of the statistics faculty, and eventually transferred to the Statistics Department.

(5) The Institute of Statistics. The Institute of Statistics is the consulting arm of the Department of Statistics. It has a Director and one full-time faculty member. Other faculty sometimes do consulting. The money generated by the Institute is used in various ways in the department, such as travel, photocopying, etc. Higher administration officials do not seem to understand fully the function of the Institute; however, it is playing a very important role for the University, and should be expanded. It also should be funded by the University and not by a single college. To clarify its function, the name should be changed to something like the Center for Statistical Consulting and Computing Services.

The Department of Statistics is at a critical juncture in its development, and what is done in the

next year or two may decide what is accomplished in the next ten. A major University must have a reputable statistics department. UCF has a small group that can be expanded to serve the university and community fully if some planning and commitment of resources are made now.

FLORIDA INTERNATIONAL UNIVERSITY

I. Background. During our 1984-85 Program Review, Statistics was in a Department of Mathematical Sciences. In 1987, FIU took the desirable step of creating three separate departments from this unit; Statistics is one of the new departments. There were only five tenure track statisticians on the Mathematical Sciences faculty, and two were not tenured. Four tenure track statisticians have been employed since the last review (one was tenured in 1989) and the two non-tenured faculty in 1985 are no longer on tenure tracks.

II. Curriculum.

(1) Course content and diversity for the undergraduate Statistics degree are excellent.

(2) Course requirements for a Statistics minor are too difficult; it is recommended that the third calculus course and one of the statistics courses be deleted from the requirements.

(3) The department has an excellent record of teaching service courses. There is one serious problem; the Business School proposes to reduce its emphasis on quantitative methods. One result of this redirection may be to take over the teaching of the statistics service courses. Such a move is contrary to that of most Business Schools in this country, and would be

detrimental to the Statistics Department. We recommend that this move be opposed by the FIU administration.

(4) Some graduate courses are needed to fulfill undergraduate degree requirements. Since graduate courses require increased tuition, we recommend that such courses be dually listed.

(5) Students desire a more extensive course in computer packages, such as SAS, and asked that the requirement of Fortran or Pascal be removed.

(6) There is a need for more use of real problems in the statistical methods courses.

(7) The proposed certificate program in Actuarial Science (joint with mathematics) and the development of a MS degree in Statistics with emphasis on quality and productivity would fulfill two important needs in the Miami area. The MS program should be a joint program with Industrial Engineering and/or Business. This arrangement is important, because students in the program will need to take business and/or manufacturing-related courses as well as courses in Statistics. An alternative procedure would have separate MS programs, each with an emphasis on quality and productivity and then to cross-list courses.

The MS program is very important as the next step in the development of the Statistics Department; it should act as a catalyst for additional research

activity and allow for more frequent offering of more advanced courses.

(8) Efforts should be made to increase the number of Statistics majors by working directly with local community colleges and high schools.

III. Faculty Evaluation.

(1) A major problem is the variability in research output. This will continue even if a MS program is approved, because the main need is for teaching. At present, each faculty member teaches 5 courses per year with an occasional increase to 6 courses. Some consideration should be paid to having a two-tier faculty, whereby (i) some members continue a heavy teaching schedule and are evaluated on this basis and (ii) other members teach no more than 4 courses per year and are evaluated on their research output as well as teaching competence.

(2) As research output receives more attention at FIU, other actions which should be taken are: develop a seminar series; establish a visiting research professorship; encourage the faculty to apply for research grants and sabbatical leaves; make summer research grants available to those who will do no teaching at that time.

(3) FIU currently has a Lecturer in Statistics who is a consultant for the Academic Computer Services. We recommend the establishment of a Center for Statistical Consulting with suitable requirements for tenure of the Director. FIU needs a strong statistical consulting group, and good statistical consulting should be recognized through the evaluation process and appropriately rewarded.

IV. Other Comments.

(1) Provide tutorial help for students taking the two semesters of statistical theory.

(2) The library was too noisy for the students.

(3) The faculty generally felt that the library and computer facilities were adequate. They would appreciate having a high speed printer for computer output and a plotter for high quality graphics.

(4) Some faculty producing research papers found it necessary to do their own typing. This could be an increasing problem in the future.

Finally, we found the FIU statistical efforts much improved over 1984-85; however, it will require an even better Statistics program if the university wishes to become a research leader.

UNIVERSITY OF NORTH FLORIDA

I. Background. The University of North Florida is the urban university for northeast Florida. It admitted its first freshmen students in 1984, when it became a four year college for full-time students; however, many of its students are still part-time and live off-campus. The campus is one of the most beautiful we have visited. There is a Department of Mathematics and Statistics in the College of Arts and Sciences, which offers BA and BS degrees in Statistics, and an MA degree in Mathematics, with a Statistics specialty. The Statistics component has increased to four Ph.D. tenure-track faculty members, all from excellent universities. It can now think of staffing in terms of specialties in some of the main branches of statistics. It still does not have a large enough faculty to justify separate department status; however, this should be an objective for the not too distant future.

II. Instruction. Using the traditional measures of student evaluations, careful advising, personal help, student feedback and student preparation, the statistics faculty must be rated as outstanding. Nevertheless, the faculty are concerned that tenure and promotion committees attribute too much significance to mean scores in student evaluations without conditioning on size of class, level of courses, etc.

The consultants' visits with current and past students were overwhelmingly convincing that good teaching is the norm in the Department, that the faculty in general are excited about it, and that the administration is very proud of this and seeks to nurture it. Thus, the evidence is that the quality of teaching is given equal consideration with research in promotion/tenure/salary decisions. The only question concerns the measurement process.

The use of adjunct instruction is not excessive.

Class size is not an issue; there are some large lecture sections of 90 students or so, but these are not large by comparison with other universities, and they are mitigated by small recitation sections.

III. Curriculum. The curriculum is well designed to provide strong and broad preparation for graduate school, as well as entry level industry and teaching positions. Courses have been provided so that a judicious selection can accomplish either purpose.

The courses are up to date.

Appropriate technology is used in the courses. A judicious mix of pocket calculator, main frame computer, and statistical packages is used at present, with continual experimentation in more or different usage of the computer in various statistics courses. The undergraduate and graduate Methods courses

provide experience in the use of several of the best packages, such as SAS, SPSS, and JMP (SAS for the MacIntosh).

IV. Graduate Programs. TA stipends are not sufficient to maintain a strong graduate program, in spite of a concerted recruiting effort; if some of the unfilled slots were filled, more of the planned graduate courses could be offered. There is an appropriate balance between graduate and undergraduate needs.

V. Service Teaching. The first chairman of the department established the exemplary process of having statistics courses across the campus taught by members of the Mathematical Sciences faculty. This continues today. Representatives of the served disciplines report that their needs are being well met, and that communications are excellent, so that they would have no hesitation in bringing up any problems that may arise (although none have arisen). We would caution the Department, however, that "cooperation that is not actively nurtured will inevitably erode," and offer a mild suggestion that at least annual meetings (over lunch, perhaps) between faculty members in statistics and in the served disciplines may be helpful in engendering confidence in each other, as well as providing the opportunity to compare notes on such things as choice of textbooks, sources of examples from the disciplines, feedback from students, etc.

VI. Consulting Service. Unfortunately this very important contribution of statisticians to the research efforts of faculty, students and outsiders is still conducted on an ad hoc basis. The reports from outside and inside users of this service were highly laudatory. (One report was that they could not get along without it.) This service is as necessary a research support facility as are the library, laboratory equipment, the computer, etc. Here we are speaking of a real research need - the proper design of an experiment, its proper analysis to obtain the best results of an experiment, and its proper analysis to obtain the best results from the minimum data at minimum cost. All of these matters are at the very heart of the scientific method, and are accepted as necessary parts of creditable research in virtually every field of human thought. Faculty will obtain statistical assistance to support their research; the questions are whether they will be able to obtain good statistical assistance, and whether the university will make this available so that it becomes a part of the UNF way of life. Any faculty which does not have access to such assistance will fall behind in the development of research, publications, grant development, etc. UNF should designate this as a Center for Statistical Consulting, with a permanent director and funds to utilize other members of the faculty on a part-time basis; the director should be at least half-time at the Center. Funding should be from the general university

funds and the department, rather than solely from the department.

VII. Other Issues.

(1) Additional secretarial support is drastically needed as research output becomes an important requirement.

(2) A departmental computer laboratory and a faculty lounge are needed.

(3) Continue the excellent articulation with public schools and community colleges.

(4) Salaries are far too low; the highest salary is below the national median for its rank. Recruiting faculty on the basis of the beautiful surroundings will not substitute for decent salaries in the future.

(5) Funds are needed for graders, a technical typist and a clerk to handle routine business.

(6) Library journal holdings need to be improved.

Finally, we congratulate the department on its balanced treatment of Statistics, a treatment which is not universal even in the Florida SUS. The group represents a wide variety of ethnic backgrounds, and presents a broad, healthy version of the academic world for students.

Appendix A

CURRICULUM VITAE OF LEAD CONSULTANTS

PETER J HILTON

Professor Hilton was Professor of Mathematics at Cornell University from 1962 to 1971. From 1971 to 1973, he held a joint appointment as Fellow of the Battelle Seattle Research Center and Professor of Mathematics at the University of Washington. He was appointed Louis D. Beaumont University Professor at Case Institute of Technology from September 1, 1972, and took up the appointment on September 1, 1973, retaining his fellowship at the Battelle Seattle Research Center, now known as a fellowship of the Battelle Seminars and Studies Program. He is currently Distinguished Professor of Mathematics, SUNY, Binghamton.

He received his M.A. degree from Oxford University, England, and Ph.D. degrees from Oxford University and Cambridge University, England. He was a Lecturer at Cambridge University, 1952-55; Senior Lecturer at Manchester University, England, 1956-58; Mason Professor of Pure Mathematics, Birmingham University, England, 1958-1962. He was Visiting Professor at the Eidgenossische Technische Hochschule at Zurich, 1966-67, 1981-82, and Visiting Professor at the Courant Institute of Mathematical Sciences, New York University, 1967-68. In 1970-71 he was on leave of absence from Cornell University as a Visiting Fellow at the Battelle Seattle Research Center.

Dr. Hilton is a member of the American Mathematical Society, the Mathematical Association of America, the London Mathematical Society, the Cambridge Philosophical Society, the Royal Statistical Society, and an honorary member of the Mathematical Society of Belgium. He was First Vice-President of the Mathematical Association of America 1978-1980. He is an honorary member of Phi Beta Kappa.

Dr. Hilton's principal research interests are in algebraic topology, horological algebra, categorical algebra, and mathematics education. He has published 15 books and over 350 articles in these areas, some jointly with colleagues.

Dr. Hilton is featured in 'Mathematical People', published by Birkhauser (Boston), 1985.

Current Positions Held

Member, American Mathematical Society Committee on Human Rights of Mathematics

Chairman, Mathematical Association of America Committee on Award for Distinguished Service

Chairman, Mathematical Association of America Committee on Award of Chauvenet Prize

Member, Mathematical Association of America Panel on Remediation

Member, Mathematical Association of America Panel on Public Representation

Member, Advisor Committee on Mathematics and Science, Council for Basic Education

Member, Phi Beta Kappa Speakers Panel

Consultant, John Wiley and Sons, Inc.

Consultant, Open Court Publishing Company

Consultant, Children's Television Workshop.

Recent Positions Held

Secretary, International Commission on Mathematical Instruction

Editor, NICO (Brussels)

Consultant, National Institute of Education, Department of Health, Education and Welfare

Chairman, United States National Research Council Committee on Applied Mathematics Training

Member, United States Commission on Mathematical Instruction, National Research Council

Chairman, Mathematical Association of America Committee on National Awards

Principal Editor, Ergebnisse der Mathematik Series, published by Springer Verlag

Editor, Educational Studies in Mathematics

Chairman, National Advisory Board, Comprehensive School Mathematics Project

Member, Committee on the Undergraduate Program on Mathematics, Mathematical Association of America

Chairman, National Research Council Committee on Graduate and Postdoctoral Training in Mathematics

Chairman, United States Commission on Mathematical Instruction, National Research Council

Member, Teacher Training Panel, Committee on the Undergraduate Program in Mathematics, Mathematical Association of America

Joint Chairman, Cambridge Conference on School Mathematics

Member, National Advisory Committee, Boston University Mathematics Project

Member, Committee on Films, Mathematical Association of America

Member, Subcommittee on Translations, Mathematical Association of America

Member, Committee on Postdoctoral Fellowships, American Mathematical Society

Chairman, New York State Department of Education Panel on Ph.D. Program in Mathematics (September, 1976)

Editor, Journal of Pure and Applied Algebra

Chairman, Committee to Select Phi Beta Kappa Book Award in Science

Honors

Silver Medal, University of Helsinki, 1975

Doctor of Humanities (hon. causa), N. Michigan Univ., 1977

Corresponding Member, Brazilian Academy of Sciences, 1979

Doctor of Science (hon. causa), Memorial University of Newfoundland, 1983

Doctor of Science (hon. causa), Universitat Autonoma de Barcelona, 1989

In August, 1983, an international conference on algebraic topology was held, under the auspices of the Canadian Mathematical Society, to mark Professor Hilton's 60th birthday. Professor hilton was presented with a Festschrift of papers dedicated to him (London Mathematical Society Lecture Notes Volume 86, 1983). The American Mathematical Society has published the proceedings under the title 'Conference on Algebraic Topology in Honor of Peter Hilton' (Contemporary Mathematics 37, AMS, 1985).

R. L. ANDERSON

DATE: October 8, 1985

TITLE: Vice President, Statistical Consultants,

CURRENT ADDRESS: 3349 Braemer Drive, Lexington, Kentucky 40502

WIFE: Mary Turner Anderson

CHILDREN: Kathryn Hart and William Bayard

PLACE OF BIRTH: North Liberty, Indiana

DATE OF BIRTH: April 20, 1915

EDUCATION BEYOND HIGH SCHOOL:

DePauw University, A.B., 1936 (Math)
Iowa State College, M.S., 1938; Ph.D., 1941 (Math., Stat. & Econ.)

EMPLOYMENT:

1936-41 - Iowa State College [Graduate Assistant]

1941-44 - North Carolina State College [Instructor and Assistant Professor (Math. & Stat.)]

1944-45 - Princeton University [OSRD Contract for Army-Navy consulting]

1945-50 - North Carolina State College [Associate Professor (Stat.)]

1950-51 - Purdue University [Visiting Professor (Stat.)]

*1951-66 - North Carolina State University [Professor (Stat.)]

1953-66 - North Carolina State University [Graduate Administrator for Dept. of Experimental Stat.]

1966-67 - University of Georgia [Visiting Research Professor (Stat.)]

1967-79 - University of Kentucky [Professor&Chairman (Stat.)]

*1958 Ford Foundation project at London School of Economics for six months.

1979-80 - University of Kentucky [Professor]

1980-85 - University of Kentucky [Assistant to the Dean, College of Agriculture, (for Statistical Services)]

1985- Statistical Consultants, Inc. [Vice President]

HONORARY SOCIETIES:

Pi Mu Epsilon, Phi Beta Kappa, Phi Kappa Phi, Gamma Sigma Delta, Sigma XI

PROFESSIONAL SOCIETIES:

American Statistical Association (Fellow, President 1983)
Board of Directors (1976-78)
Member of Census Advisory Committee (1972-77; Chm. 1977)
Member Committee on Statistics & the Environment (1977- ; Chm. 1980-81)
Chairman, Steering Committee of ASA (Office of Radiation Programs, EPA (1981-82)
Institute of Mathematical Statistics (Fellow)
Member of Council (1955-57, 1962-64)
Member of Committee on Mathematical Tables (1954-69)
Chairman, High Speed Computer Committee (1955-57)
Associate Editor, Annals of Math. Statistics (1971-1973)
Member, Committee on Fellows (1972-74; Chm. 1974)
Chairman, Publications Committee (1974-75)
American Association for the Advancement of Science (Fellow)
Chairman, Section U (1979)
Biometrics Society
President, Eastern North American Region (1966);
Council (1968-70, 1972-74)
International Statistical Institute
International Association for Statistical Computing (Council, 1981-85).

PROFESSIONAL AND ACADEMIC POSITIONS, HONORS, ETC.:

<u>North Carolina State University</u>

Member of the Administrative Board of the Graduate School (1960-66)
Chairman, Operations Research Technical Committee (1964-66)
Member of the Faculty Senate (1964-66), Vice Chairman (1965-66)
Directed 9 Master's and 26 Ph.D. Theses

<u>University of Kentucky</u>

Member of Southern Regional Education Board's Committee on Statistics (Chairman, 1975-77)

Member of Graduate Council (1968-71)
Acting Chairman of Computer Science (1969-70)
Member of University Senate (1970-72)
Technical Advisory Committee, Tobacco & Health Research Institute: Member, (1971-72); Chairman, (1972-78)
Directed 4 and co-directed 2 Ph.D. dissertations
Member of Survey Research Center Advisory Committee (1979-80)

Scientific Directories

American Men of Science -- Physical and Biological Sciences
World Directory of Mathematicians
Leaders in American Science
Who's Who in the South and Southwest
Who's Who in America
Dictionary of International Biography

Other

Regional Editor, Statistical Theory&Method Abstracts (1958-67)
National Science Foundation Visiting Lecturer in Statistics (1964-65)
Member, USDA Agricultural Economics Research Advisory Committee (1965-68)
Seminar on Sampling of Bulk Materials, held in Tokyo, November 15-18, 1965, sponsored by our NSF and Japan Society for the promotion of Science. Lectured at Kyushu, Hiroshima, Tokyo and Nibon Universities and Institute of Statistical Mathematics.
Inaugural Conference of Scientific Computation Center, University of Cairo, December 12-20, 1969
Member of Editorial Board of Communications in Statistics, 1972-85
AID Workshop on Experimental Designs for Predicting Crop Productivity, University of Hawaii, May 1974
Co-Chairman of Workshop on Standards for Evaluation of Statistical Software at the Eighth Annual Symposium on the Interface between Computer Science and Statistics, February 13-14, 1975, Health Sciences Computing Facility, University of California, Los Angeles
Visiting Professor, University of Umea (Sweden), September 1977 and Indian Statistical Institute at Delhi, Oct-Dec. 1977
Participated in 1978 Midwest Conference on Statistics at Southern Illinois University-Carbondale
Member of Office of Technology Assessment's Panel on Monitoring for Toxic Substances in Foods, 1978-79

CONSULTING EXPERIENCE:

OSRD - Army and Navy War Research (1944-45)
Human Resource Research Institute, Maxwell AFB (1952)
TVA Study on Optimal Rates of Fertilization (1955-62)

Materials Eng. Lab., Westinghouse Electric Company (1957)
Aerospace Medical Center (1961)
U.S. Army Research and Development Conference on Design of Experiments (1961)
Space Technology Lab., Los Angeles (1962)
Research Triangle Institute (1962-64)
Bettis Atomic Power Division of Westinghouse Electric Company (1962-63)
Pan American World Airways, Guided Missile Division, Patrick Air Force Base (1963-67)
Institute for Defense Analyses (1965-66)
U.S. Army Missile Command, Redstone Arsenal (1968)
International Mathematical and Statistical Libraries, Inc. (IMSL): Member Advisory Board (1971-89)
Merrill Laboratories; Smith Kline and French Labs, Adria Labs, DuPont Petroleum Lab
Meidinger Measurement Systems (1973)
AID (State Department) Project on Transferability of Information on Crop Productivity (1974)
UCLA Health Sciences Computing Facility (1974, 1975, 1978, 1980)

FIELDS OF RESEARCH INTEREST:

Experimental designs and estimating procedures for variance components; effect of misclassification in the analysis of frequency data; time series analysis; selection of predictors in regression analysis, use of prior information in regression analysis; designs and estimators for optimal applications.

PUBLICATIONS:

1. Distribution of serial correlation coefficient. Ann. Math. Stat. 13:1-12. 1942.

2. (with E. E. Houseman) Tables of Orthogonal Polynomial Values Extended to N = 104. Iowa Agr. Exp. Sta. Bull. 297. 1942.

3. Missing-plot techniques. Biometrics 2:41-47. 1946.

4. Use of variance components in the analysis of hog prices in two markets. Jour. Amer. Stat. Assn. 42:612-634. 1947.

5. (with H. L. Manning) An experimental design used to estimate the optimum planning date for cotton. Biometrics 4:171-196. 1948.

6. The use of regression techniques with economic data. Proc. Auburn Conf. on Stat. Applied to Res. in Social Sci. Plant and Anim. Sci. pp. 3-14. Inst. of Statistics Mimeo Series 11, 1948.

7. (with T. W. Anderson) Distribution of the circular serial correlation coefficient for residuals from a fitted Fourier series. Ann. Math. Stat. 21:59-81. 1950.

8. Tests of significance in time-series analysis. Stat. Inference in Dynamic Ec. Models. Chap. 13. pp. 352-355. 1950. Cowles Commission Monograph No. 10.

9. (with T. A. Bancroft) Statistical Theory in Research. McGraw-Hill Book Co., Inc., New York. 1952

10. Proper planning reduces research errors. Jour. Farm Econ. 35:572-581. 1953.

11. Recent advances in finding best operating conditions. Jour. Amer. Stat. Assn. 48:789-798. 1953.

12. The problem of autocorrelation in regression analysis. Jour. Amer. Stat. Assn. 49:112-129. 1954.

13. (with A. R. Sen and A. L. Finkner) A comparison of stratified two-stage sampling systems, selecting one or two primary sampling units per stratum. Jour. Amer. Stats. Assn. 49:539-558. 1954.

14. Components of variance and mixed models. Qual Control Convention Papers, Eighth Annual Convention Amer. Soc. Qual. Control, pp. 633-645. 1954

15. (with R. G. Cragle, et al) The effects of various levels of sodium citrate glycerol and equilibration time of survival of bovine spermatozoa after storage at -79 degrees C. Jour. Dairy Sci. 38:508-514. 1955.

16. (with F. E. Binet, et al) Analysis of Confounded Factorials in Single Replications. N.C. Agr. Exp. Sta. Tech. Bull. 113. 1955.

17. A comparison of discrete and continuous models in agricultural production analysis.
    Methodological Procedures in the Economic Analysis of Fertilizer Use Data - Edited by E. L. Baum. et al. Iowa State College Press, Chap. 3, pp. 39-61. 1956.

18. Some statistical problems in the analysis of fertilizer response data. Econ. and Tech. Analysis of Fertilizer Innovation and Resource Use. Edited by E. L. Baum. et al. Iowa State College Press, Chapter 17, pp. 187-206. 1957.

19. Complete factorials, fractional factorials and confounding. Experimental Designs in Industry. Edited by Victor Chew. John Wiley and Sons, Inc., New York, pp. 58-107. 1958.

20. Use of contingency tables in the analysis of consumer preference studies. Biometrics 15:582-590. 1959.

21. Uses of variance component analysis in the interpretation of biological experiments. Bull. Int. Statist. Inst. 37. Part 3, 71-90. 1960.

22. Some remarks on the design and analysis of factorial experiments. Contributions to Probability and Statistics. Edited by I. Olkin, et al. Stanford University Press. Chapter 5, pp. 35-56. 1960.

23. Designs for estimating variance components. Proceedings of the Seventh Conf. on the Design of Experiments in Army Research Development and Testing, pp. 781-823. Fort Monmouth, New Jersey, October 18-20, 1961. Inst. Stat. Mimeo Ser. 310.

24. (with W. T. Wells and J. W. Cell). The distribution of the product of two central or non-central chi-square variates. Ann. Math. Statist. 33:1016-1020. 1962.

25. (with Norman Bush) A comparison of three different procedures for estimating variance components. Technometrics. 5:421-440. 1963.

26. (with R. M. Zaki and B. B. Bhattacharyya) On a problem of production planning for a non-storable commodity. Management Science 10/3:477-487. 1964.

27. The analysis of regression models based on measured and classification predictor variables with special reference to the analysis of the AZUSA MK I AR data. Tech. Staff Tech. Memo No. 15, Pan American World Airways, Inc., Patrick Air Force Base, Florida. May 11, 1964.

28. An investigation of the stability of estimates of error model parameters for MISTRAM - Final IG data on missile test 354. Tech. Staff Tech. Memo No 18, Pan American World Airways, Inc., Patrick Air Force Base, Florida. 11/10/64.

29. (with W. T. Wells) A discussion of best estimate of trajectory. Tech. Staff Tech. Memo No. 21, Pan American World Airways, Inc. Patrick AFB, Florida. 12/1/64.

30. (with V. L. Mote) An investigation of the effect of misclassification on the properties of X - tests in the analysis of categorical data. Biometrika 52:95-109. 1965.

31. Non-balanced experimental designs for estimating variance components. Report of Seminar on Sampling Bulk Materials, U.S. - Japan Cooperative Science Program, November 15-18, 1965, Tokyo, Japan. Inst. Stat. Mimeo Ser. No. 452.

32. The effect of neglecting certain measurement correlations in estimating trajectory parameters. Tech. Staff Tech. Memo No. 56, Pan American World Airways, Inc., Patrick Air Force Base, Florida. July 19, 1966.

33. The effect of neglecting certain measurement correlations in estimating trajectory parameters, using MISTRAM I and II and four X-band vans. Tech. Staff Tech. Memo No. 77, Pan American World Airways, Inc., Patrick Air Force Base, Florida. July 31, 1967.

34. (with K. Kussmaul) Estimation of variance components in two-stage nested designs with composite samples. Technometrics 9:373-389. 1967.

35. (with P. P. Crump) Comparison of designs and estimation procedures for estimating parameters in a two-stage nested process. Technometrics 9:499-516. 1967.

36. Non-balanced designs to estimate variance components. Proceedings of the Sixth International Biometrics Conference. 5:117-150. Sydney, Australia. Aug. 25, 1967.

37. The use of prior information in regression analysis. Economic Models, Estimation and Risk Programming: Essays in Honor of Gerhard Tintner. Chapter 13, pp. 302-324. Springer-Verlag, New York. 1969.

38. Use of computers in statistical teaching, consulting and research. Proceedings of Inaugural Conference for Scientific Computation Center, Cairo, UAR, Dec. 1969.

39. (with D. M. Allen and F. B. Cady) Selection of predictor variables in linear multiple regression. Statistical Papers in Honor of George W. Snedecor. Edited by T. A. Bancroft. Chapter 1, Iowa State Univ. Press. 1972.

40. (with D. W. Gaylor and H. L. Lucas) Calculation of expected mean squares by the Abbreviated Doolittle and Square Root Methods. Biometrics 26:641-655. 1970.

41. (with P. J. Kendell) An estimation problem in life testing Technometrics. Vol. 13, No. 2, pp. 289-301. 1971.

42. (with L. A. Nelson) Some problems in the estimation of single nutrient response functions. Bulletin International Statistical Institute. 44:Part I:203-222. 1971.

43. (with H. Sahai) Confidence regions for variance ratios of random models for balanced data. Journal of the American Statistical Association. 68:951-952. 1973.

44. (with D. M. Allen and F. B. Cady) Analyzing a Series of Soil Fertility Experiments for Predication. Exploring Data Analysis: The Computer Revolution in Statistics. Edited by W. J. Dixon and W. L. Nicholson: Univ. of California Press, Los Angeles, Chapter 6, pp. 313-325. 1974.

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APPENDIX C

MATHEMATICS/STATISTICS PROGRAM REVIEW

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Dr. Betsey Whitman, Chair

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Dr. Ken Pothoven, Chairman

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Dr. Pete Rautenstrauch, Assoc. Professor

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Dr. Luis Escovar, Associate Dean

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Dr. Leonard Lipkin, Chairman

BOR Coordinator/Faculty Program Consultant
Dr. Bill Caldwell

APPENDIX D

Salary Survey, Departments of Statistics

(Editor's Note: We are grateful to Professor Robert V. Hogg for supplying this report which appeared in AMSTAT NEWS, December,1989 (page 21), Professor Hogg's address is Department of Statistics & Actuarial Science, University of Iowa, Iowa City, Iowa 52242.)

In October of this year, 51 departments of statistics (most of which are in colleges of arts and/or sciences) were contacted and 51 responded (how about that!). Of these 51, three private universities were unable to release their figures. Thus salaries of the faculty in 48 departments are included in the following summary. From these statistics (and the original "stem and leaf" diagrams), again it is quite clear that higher starting salaries are causing compression among the assistant professors and somewhat among the associate professors. This is not necessarily bad as it should help salary increases in the future.

Salaries for the Academic Year 1989-90

		No.	First Quartile	Median	Third Quartile
Assistant Professors					
Years	1	39	34,800	36,000	37,000
in	2	34	34,700	36,000	37,800
Rank	3	30	35,000	36,300	39,000
	4	22	34,600	35,500	40,000
	5 or more	27	34,800	37,200	39,500
Associate Professors					
Years	1-2	41	38,200	40,800	45,800
in	3-4	27	40,600	43,400	46,600
Rank	5-6	30	40,600	45,000	48,400
	7 or more	62	38,400	43,100	47,700
Professors					
Years	1-3	40	48,500	53,200	64,200
in	4-6	38	49,600	55,600	66,400
Rank	7-9	41	53,400	61,300	72,700
	10-12	50	53,000	60,600	71,500
	13-15	35	51,400	62,400	69,000
	16-18	41	57,100	70,000	79,000
	19-21	31	52,400	67,000	78,200
	22-24	33	53,000	65,700	77,600
	25 or more	38	52,400	68,000	85,600